INTERNATIONAL NICKEL
MAGAZINE

1971/1

NO HEADFRAME AT LEVACK WEST

The newest of International Nickel's growing number of mines in Canada—Levack West—is expected to come into production in 1975. Clearing of the site, in the Sudbury District of Ontario, was begun last fall and development work is now under way.

In the scene above, however, a familiar sight is absent. Levack West will be the first new Inco underground mine without a headframe. Here workmen are beginning excavation of the adit. No shaft will be sunk. From the surface, a 9,000-foot circling ramp will be driven to carry personnel and supplies to all working levels. Ore will be transferred by rail to Inco's nearby Levack mine through a 1½-mile-long tunnel driven 1,600 feet below the surface to connect the two mines. Hoisted to the surface through Levack's No. 2 shaft, the ore will then be treated at the Levack mill.

The new mine, with an estimated capital cost of $21 million, will have a capacity of approximately 2,500 tons of ore per day. This will compensate for the reducing availability of ore from the present Levack mine and, by the middle of the decade, will help lift International Nickel's production capacity in Canada to between 615 and 630 million pounds of nickel per year.

Photograph by Derek Wing, Inco Canada

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The Cover

"Nickel is where you find it." But finding it is no easy task, as Inco's H. F. Zurbrigg reports authoritatively in an interview with Joseph Boldt featured in this issue. Exploration involves prospectors with picks, sometimes tramping endless miles through desolate, snowy wilderness. Thus it has ever been. But today, the helicopter, the airplane with sophisticated sensing equipment, the magnetic field map, and the geologist in the laboratory are likely to be more effective ways of finding nickel.

The search has taken Inco explorers into far corners of the globe to meet some fascinating but little-known people. The reader can meet some of them himself in Lance Nelson's photographic essay, "Sulawesi." Thousands of miles away are some other fine people who are "Sharing An Anniversary Of Progress."

What motivates men to search so far? A metal so versatile that the legendary American lawman Bat Masterson (page 24) and next year's Olympic athletes (page 30) can be described as nickel users.

INTERNATIONAL NICKEL MAGAZINE

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Robert Stahman

THE SEARCH

H. Franklin Zurbrigg, vice-president in charge of exploration of The International Nickel Company of Canada, Limited, is a world authority on the occurrence of nickel in the earth's crust and on exploration to locate it in commercial concentrations. He joined the company as a mines geologist after receiving a Master of Science degree from Queen's University at Kingston, Ontario, in 1933, and has held progressively more responsible positions over the years. Talking with Joseph R. Boldt, Jr. (left), in a series of taped interviews, he ranged widely over the subject of Inco's search for new nickel ores. Highlights from the tape transcripts provide material for two articles. The main emphasis of the first is on Canada and the sulphide ores; a later article will deal with Inco exploration activities overseas and the laterites.

JRB: Your title is "vice-president for exploration." Obviously Inco accords a lot of importance to exploration to make it a full vice-presidential department of the company.

ZURBRIGG: A lot of importance, and for good reason. Through exploration we find the raw material we must have to stay alive. Fortunately, the world is so hungry for nickel, it is buying all we can produce. So we can afford to take the big risks the search requires.

JRB: How big? What does the company spend on exploration?

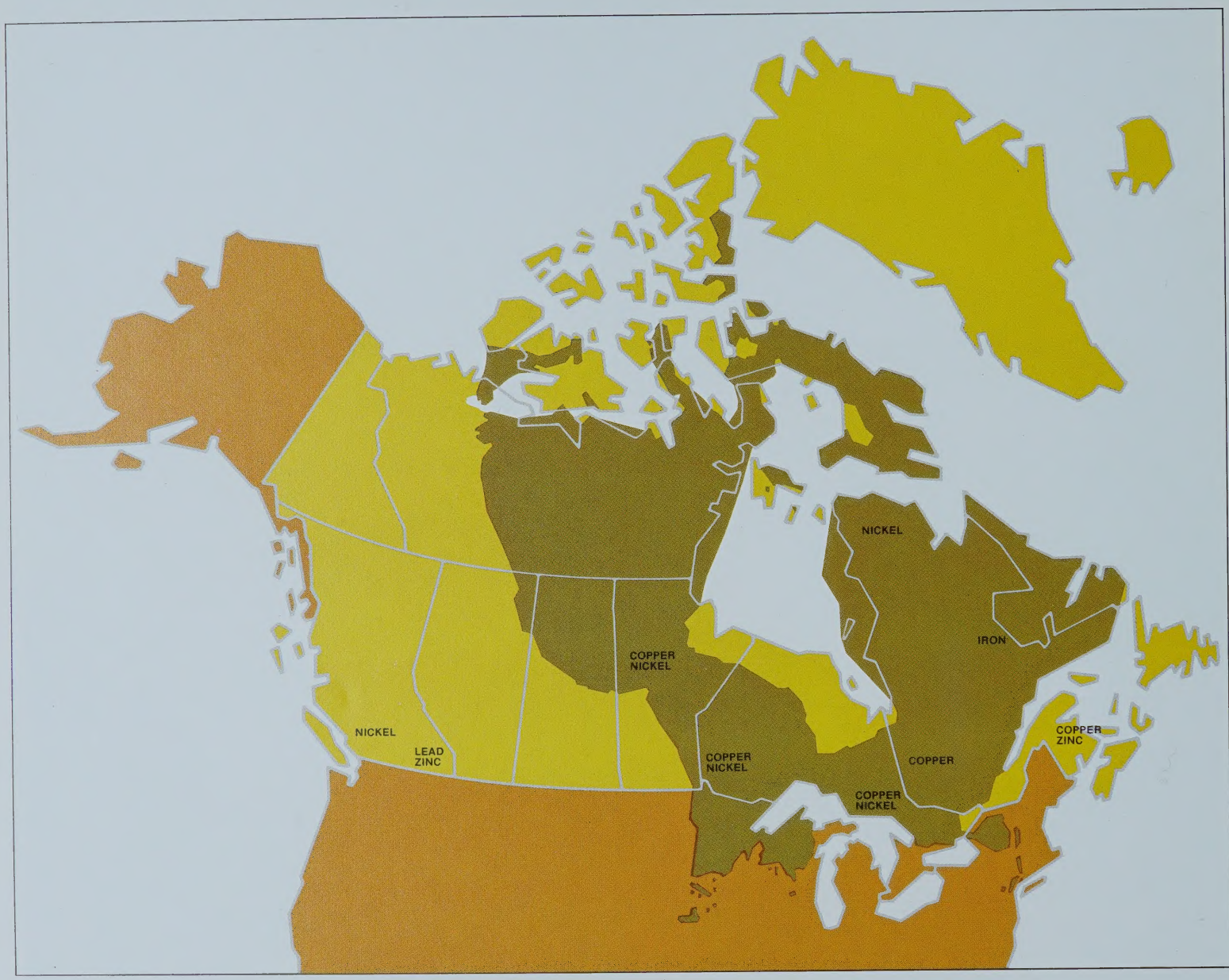
ZURBRIGG: In 1970 we spent 35 million dollars. Our budget for 1971 is about $38 million.

JRB: Are you exploring only for nickel?

ZURBRIGG: Nickel is our prime target. Basically, we're looking for any mineral deposits that could be profitable for the company—any deposits, whether found by ourselves or by outsiders who bring them to us, the company then taking up an option on them, investigating them, releasing them if they turn out to be valueless to us, or retaining them if they turn out to be worthwhile. But normally our men go into the field in areas containing rocks that are known to be favourable hosts to nickel.

JRB: You may go looking anywhere in the world?

ZURBRIGG: Anywhere in the world where the risks, versus the possible return, are acceptable. More so all the



Areas where major commercial metal deposits have been found in Canada. The olive colour indicates the Precambrian Shield, where the earth's most ancient rocks are exposed at surface, and the search for nickel is carried out most intensively.

PICTURE CREDITS

Page 3 : Eddie Lau, Inco, Inc.
Page 4 : Map by Bernard Gervey
Page 6 (right): Louis Palmieri
Page 9 (left) : Clive Webster

time—about 40 per cent of our exploration monies are now spent outside North America. But our most intensive efforts continue to be in Canada.

Finding The Right Rock

JRB: Considering how few important new commercial deposits have been turned up in the past 50 years, searching the earth's crust for nickel must be analogous to the proverbial needle hunt in a haystack.

ZURBRIGG: That's not a good analogy, because a haystack isn't a logical environment in which to look for a needle. Our whole exploration procedure is based on searching in the right environment for nickel.

JRB: The right geological environment?

ZURBRIGG: That first of all. Where the right rock is—which means ultrabasic or basic rock.

JRB: Why are those rocks right?

ZURBRIGG: Because they are the rocks that contain nickel to begin with. Peridotite, which is the common ultrabasic rock, normally contains about 0.2 per cent nickel, and gabbro, the chief basic rock, about 0.02 per cent.

JRB: So you go where the nickel-containing rocks are—and you hope you'll find they have been through some sequence of geological events that has concentrated their nickel content?

ZURBRIGG: That's right.

JRB: What kind of events?

ZURBRIGG: If sulphur is present during formation of the rock, it acts as a collector of the nickel and may produce a sulphide ore. If it is not present, the nickel is caught up in silicate minerals. Subsequent exposure of the rock at surface may result in a weathering history that produces a nickel-rich residual soil. That kind of soil may comprise a lateritic ore body—an oxide ore.

JRB: There are only two ore-making mechanisms?

ZURBRIGG: Only two—the one involving the role of sulphur as a collector of nickel, the other the role of weathering as a concentrator of nickel.

JRB: Is the right geological environment just a matter of the right rock being located there?

ZURBRIGG: No. When you have found the right rock, then the question is, where in the rock? You have to explore it, have to look for special places in which mineralized deposits may occur. In the case of sulphide deposits particularly, you look for likely structures.

The Importance Of Geography And Politics

JRB: You indicated before that there's more to the right environment than the geology of the area?

ZURBRIGG: The environment ought also to be right geographically. There's no particular merit in finding a mineral deposit located in some geographic area where it would be impossible to mine at a profit—for instance, in a place where no transportation or infrastructure facilities will be available in the foreseeable future. And the political environment is important. We don't look in places, for instance, where we wouldn't be welcomed—or where we couldn't get title

An Inco exploration aircraft (left) *carries sensing equipment for locating sulphide deposits by detecting anomalies in the earth's magnetic field and in the conductivity of the rock below. A man on the ground makes a detailed follow-up with a magnetometer, and a geologist in the field examines the mineral structure of a drill core.*

to what we might find. We wouldn't by choice give preference to a place where we would get only tenuous title to a deposit because of the instability of the area's government.

JRB: Finding the right environmental combinations all over the world, and arriving at some priority scheme for carrying out exploration, must take a lot of doing. How do you organize for that kind of global operation?

ZURBRIGG: Our headquarters are in Toronto, headed up by a director of exploration. The department has five divisions: Geological research, Applied geophysics, Mines exploration, Field exploration, and staff functions. In addition to the usual administrative matters, the director of staff functions is in charge of feasibility studies and control of property—its status with respect to mining claims, options, permits, leases, and so forth. He has a group of staff geologists who are responsible for initial appraisal of areas for exploration.

In The Field And In The Lab

JRB: Geological research. This implies that some right rock is more right than other right rock?

ZURBRIGG: Yes. This is where a large part of our problem lies in the field. You find the right kind of rock and explore it, but when do you quit?

JRB: You're researching for indices that enable you to say this is a particularly good rock because of some special characteristics?

ZURBRIGG: Some texture, perhaps. Or some ratio in which minerals or elements are found to occur. We're investigating many possibilities.

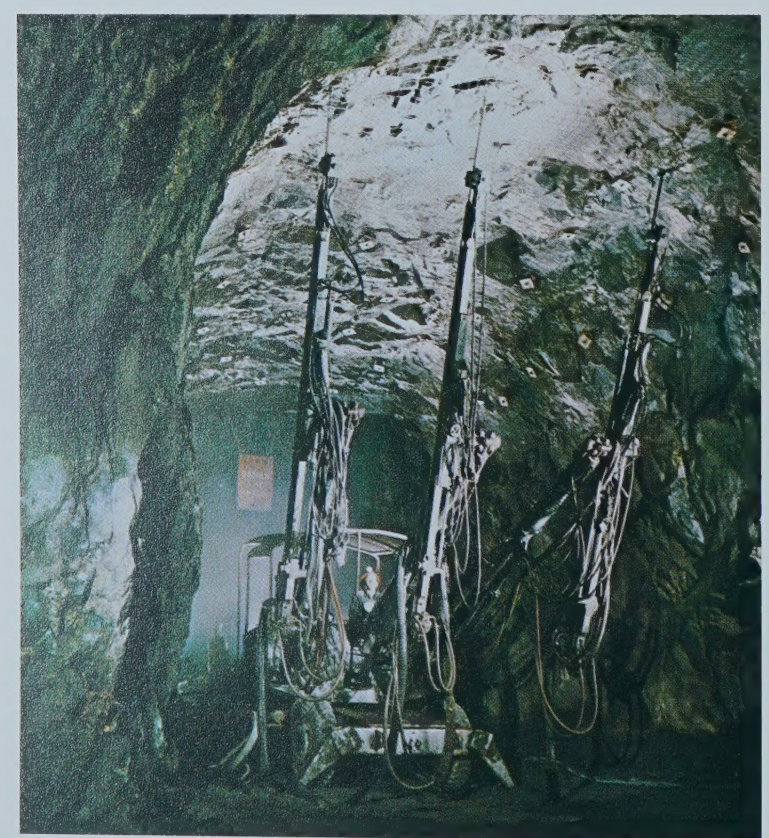
JRB: Do you research for structural as well as mineralogical clues?

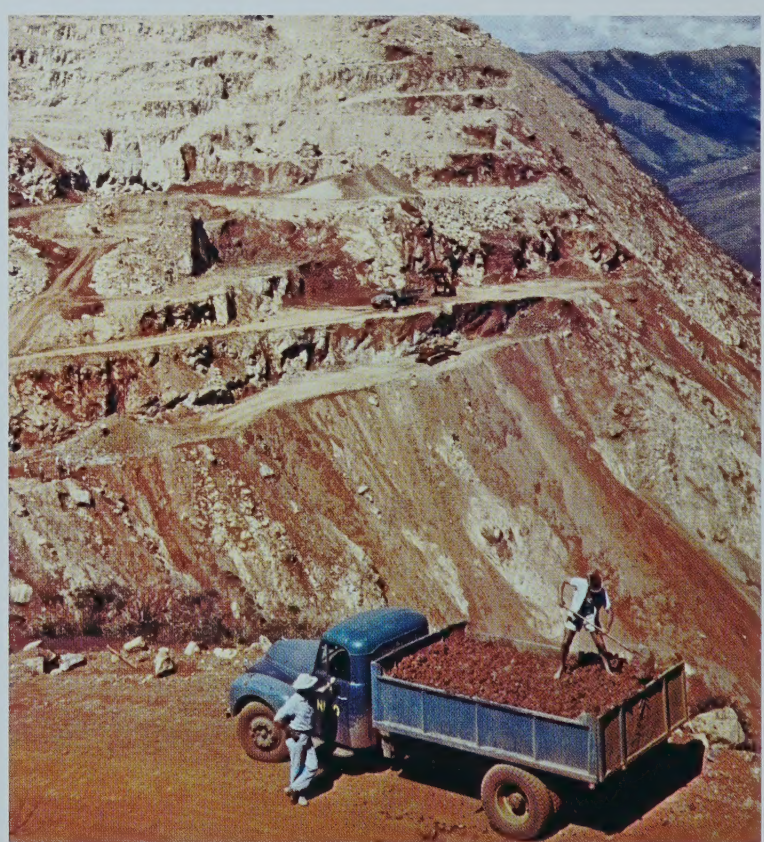
ZURBRIGG: Yes. The same men may do one part of their work in the laboratory, and make another kind of observation that has to do with rock structures in the field. The field observations are combined with those made in the laboratory for the final evaluation as to whether a particular ultrabasic or basic rock is one we want to work on a high priority basis.

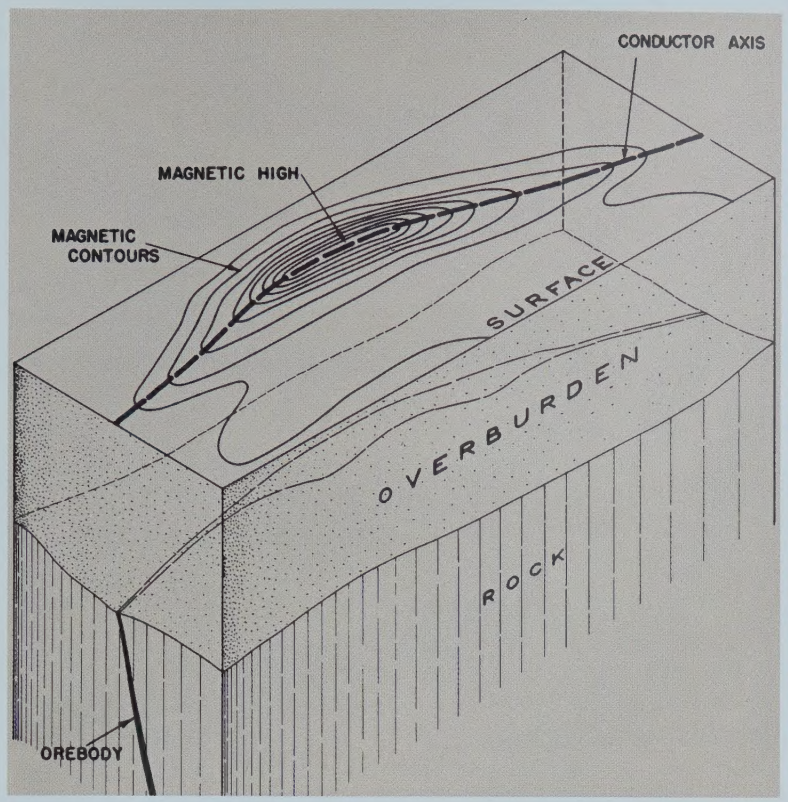
JRB: How do you get systemized data in areas where you're exploring?

ZURBRIGG: We have established eight field assay stations in various parts of the world. There's one at our new mine in Shebandowan, Ontario. The others are in Guatemala, New Caledonia, Australia, the Solomon Islands, and on the island of Sulawesi in Indonesia. They are laboratories that prepare and analyze the samples collected by the field exploration teams. They use essentially the atomic absorption method for deter-

Two kinds of nickel ore: hard-rock sulphides that almost always must be drilled or blasted in underground operations; and oxide (laterite) deposits, usually clay-like, which occur near the surface.







The drawing shows how magnetic field and conductivity findings can be combined to indicate the presence of an unexposed ore body. Special photography obtained by aircraft and satellite may give clues that help locate mineral deposits concealed by overburden.

mining the content of nickel, copper, cobalt, iron, and other metals.

JRB: What else in geological research?

ZURBRIGG: We have people who do forward-looking things with computers—developing systems and programs for dealing with all kinds of exploration information that people by themselves can't cope with because it just takes too much time. We are learning more all the time about automating masses of raw geological data in order to extract useful information from them quickly.

A Task For People Better Equipped

JRB: Computers are a far cry from the oldtime prospectors who explored by looking along the ground for outcrops—for mineralization. To how great an extent has Canada in particular been tramped, explored by eye and rock sampling? Have all the possible outcrop areas been looked at?

ZURBRIGG: No, there will always be some that remain to be found, but the law of diminishing returns operates. The obvious, the easier deposits have been found. The search becomes more and more a task for people better equipped—with funds for doing the work, with scientific knowledge for determining where to look, with know-how in using modern research equipment. Since the worthwhile new deposits are likely to be found under soil, water, or rock cover, we depend for discovery on methods that give us some indirect indication of their presence.

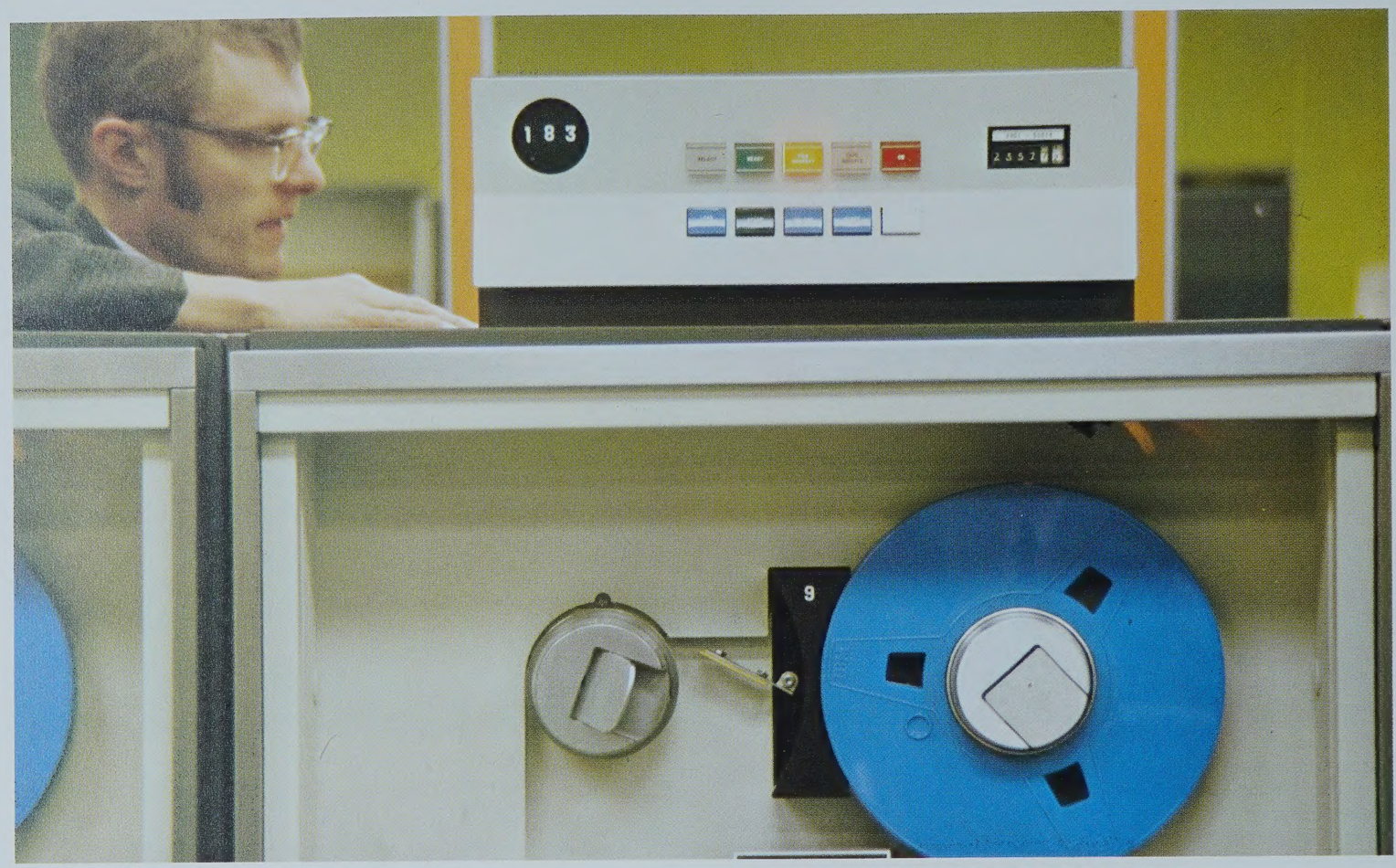
Two Basic Methods

JRB: These methods are geophysical and geochemical?

ZURBRIGG: In Canada they are mainly geophysical. We have not found geochemistry to be of much use in our work in the Precambrian Shield area, where we do so much of our searching, mainly because the soil above is not a true reflection of the underlying rock. The glacial overburden that covers much of Canada consists largely of sands, gravels, and impervious clays that have been transported there—it is not the result of disintegration of the rocks beneath. We do use geochemistry successfully in other parts of the world.

JRB: It is well known, of course, that Inco pioneered exploration by the airborne electromagnetic method.

ZURBRIGG: In our search for sulphide nickel deposits we depend very much on airborne geophysics for detecting anomalies—deviations from the norm in measurements from one point to another. The geophysics group has six aircraft for this purpose, one a research plane. The two methods we use most are air-magnetic and air-electromagnetic, in combination. The first detects anom-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(Above) *As the flood of raw geological data mounts, the computer becomes an increasingly important research tool.*
(Below) *Inco research geologists examine microscopically the unique physical properties of ore to help determine the constituent minerals present.*

alies in the earth's magnetic field. These may be caused, for example, by pyrrhotite, which is a virtually universal constituent of sulphide nickel deposits. The electromagnetic methods detect anomalies in the earth's electrical conductivity, such as those caused by sulphides, which are good conductors compared to ordinary rock.

JRB: You also use other geophysical methods?

ZURBRIGG: Yes—gravimetric surveys to spot anomalies in the earth's gravitational pull, seismic surveys, induced polarization—which is another electromagnetic method—and others. Our geophysical research people are always seeking new methods, or improvements in the old—both by devising new equipment themselves, and by evaluating developments of others.

To Be Sure Nothing's Missed

JRB: How deep in the earth can you detect anomalies with present geophysical equipment?

ZURBRIGG: Three, maybe four hundred feet as a rule. We need to develop equipment that will sense deeper. Of more concern at present is the fact that probably less than one-tenth of one per cent of the anomalies we investigate prove to be associated with mineral deposits of possible commercial interest. The physical methods give you no indication of the chemical composition of the material that's causing an anomaly.

JRB: Among your geophysical anomalies you must have borderline cases that come close to being ore bodies but don't quite qualify?

ZURBRIGG: Yes, the last thing we like to find in following up on any kind of anomaly is a mineral deposit that has only very small amounts of metal of possible commercial interest.

JRB: You feel that if you look further in depth or laterally, you may find something better?

ZURBRIGG: That's what worries us all the time. We have to be careful not to quit too soon. So the tendency is to lean over backward, to be sure that nothing's missed or overlooked.

Another Thompson?

JRB: You've been quoted as saying you don't expect to find another Sudbury Basin in Canada—but that you might well find more deposits like those you discovered in Thompson, Manitoba.

ZURBRIGG: Let's clear that up. It is correct to say that we do not expect to find something like the Sudbury Basin deposits in Canada, because that kind of occurrence makes a big target, and there's been a lot of looking all over Canada. If something like that exists, then it's in an obscure place. It's under a very big lake, or under a very extensive area of overburden without outcrops. But we can always hope.

JRB: Does this perhaps relate to the astroblem theory?

ZURBRIGG: I didn't want to get into that, but the answer is yes. We have found convincing evidence that the geological events at Sudbury were triggered by a meteoritic impact that fractured the earth's crust, and led to the upward movement of basic rocks with associated nickel mineralization. We know of no comparable meteoritic event in Canada.

JRB: You think, then, you're much more likely to find a Thompson type deposit?

ZURBRIGG: More likely. There's more of the Thompson kind of rock around, more of that same kind of geological environment than of the Sudbury kind. But I must stress that the similarities to be found in all the world's sulphide nickel deposits are a lot greater than the differences. They all have the right kinds of rock, they all have the same assembly of sulphide minerals, and they all have structural similarities with regard to how they occur and where the ore is going to be.

JRB: So you feel you pretty much know where you should look and what you are likely to find?

ZURBRIGG: That's not quite right—that's a trap the unwary can easily fall into. We still have things to learn about ore occurrence. The best, most scientific exploration people stand to lose unless they give some credence to the old-timers' motto, "Ore is where you find it."

Director of Exploration R. R. Taylor (second from left) *and key staff members evaluate a great variety of data about each area before assigning exploration priorities.*

Research geologists find scale models useful tools in studying the structure of ore bodies.

SULAWESI

by S. ADOLF RATULANGI

Photographs by LANCE NELSON

Sulawesi got its name because of a misunderstanding between the first Caucasian to set foot on the island and the local king who met him. As the story goes, the Caucasian, captain of a ship looking for the Spice Islands, landed to investigate where he was. Not knowing the name of the island, he proceeded to ask the local king, to whom he was introduced in sign language. The king, wearing his traditional dress complete with iron sword (supposedly made from the iron ore which is abundantly found in the central part of the island), thought that the stranger was inquiring about the weapon. He proudly patted the sword and said "sele besi," meaning "iron sword" ("sele" means sword, "besi" means iron). The Caucasian captain accepted the king's answer as the name of the island and spelled it C-E-L-E-B-E-S, which was later changed by Indonesians into "Sulawesi."

Orchid Of The Equator

A part of the Republic of Indonesia, Sulawesi's strangely formed shape has been likened to a spider or deadly scorpion. However, this peculiar shape is at once capricious, beautiful, and also mysterious. Romantically, Sulawesi has been nicknamed "the orchid of the equator," as its high-mountain narrow peninsulas have just enough land to embrace three large gulfs—Tomini, Tolo, and Bone. The island stretches 800 miles, north to south, while numerous small bays and inlets give it a shoreline 2000 miles long, almost entirely covered by ever-green coconut trees.

With 72,986 square miles, Sulawesi is the third largest island of Indonesia's archipelago of 13,766 islands. It is the nation's second largest revenue producer. But the population of nine million constitutes only 7.4 per cent of Indonesia's 115 million people.

A Number Of Groups

Sulawesi's inhabitants can be divided into ten groups: the Minahassa, Bolang-Mongondow, Gorontalo, and Tomini in the north; the Toradja and Loinan in the central part and east; and the Makassar, Bugis, and Bungku-Mori-Laki groups in the south and southeastern parts. The Toala, who occupy a territory in the central part of the "southern leg" of the island, just east of Makassar, is the smallest group, but they are unique because of their difference in appearance from all other Sulawesi inhabitants. The Toalas are Veddoids and they are regarded as the earliest settlers of the island, dating back to the second millennium B.C. Their way of life today is still very simple and primitive, compared to the other groups.

The nine other groups are from the Malay branch of the Mongoloid racial stock. This again can be divided into the "Proto-Malay" (more Mongoloid in appearance than Malay) and the "Deutero-Malay" groups. The Minahassans in the extreme northern leg of the island are Proto-Malay; all others are from the Deutero-Malay stock.

But the people of Sulawesi themselves believe that they are descendants from the first persons on earth. As the legend goes, the people of the Minahassa believe they are descendants of Lumimuut, the woman created by the Gods in the Heavens to settle down in Sulawesi, and her son, Toar. Lumimuut at one time was told to face the west. She became pregnant and eventually bore a son, Toar. The legend continues that Toar married Lumimuut and they thus became the ancestors of the Minahassans. Similar legends are also found in the southern and central parts of Sulawesi. Here, the Toradja, Makassar, and Buginese peoples believe they are descendants from Tomanurung-Tamborolangie, who was sent by the Gods to rule this area.

Helping Each Other

The peoples of Sulawesi are well endowed in their traditions and cultural heritage. Each group has its own way of living, habits, cultural dances, and traditions. Most have different languages, even though in some cases similar words and expressions are used in more than one group. Universally, they all have a tradition of helping each other in a sense of "mutual-help," e.g., in harvesting the land, the opening of new areas for farming, and other community undertakings.

The Makassar and Buginese groups are well known for their sailing to faraway lands. It is known that they have sailed to Madagascar in East Africa. The Toradjas are well known for their peculiar traditions, including the celebrated and splendidly decorated rice barns and houses. Their manners, customs, and religious ceremonies focus attention on an age-old Feast of the Dead and its elaborate ritual, cliff-face graves near Lemo-Lemo, and lively market scenes in the nearby town of Rantepao. The Toradjas are mostly Christians. In the extreme northern part, the Minahassans who inhabit this nocturnal paradise are believed to be related to northern people by reason of their dialect and facial features. Here also are found lilting tunes, melodious music, and exquisite dances—all outward manifestations of the happy Minahassan temperament.

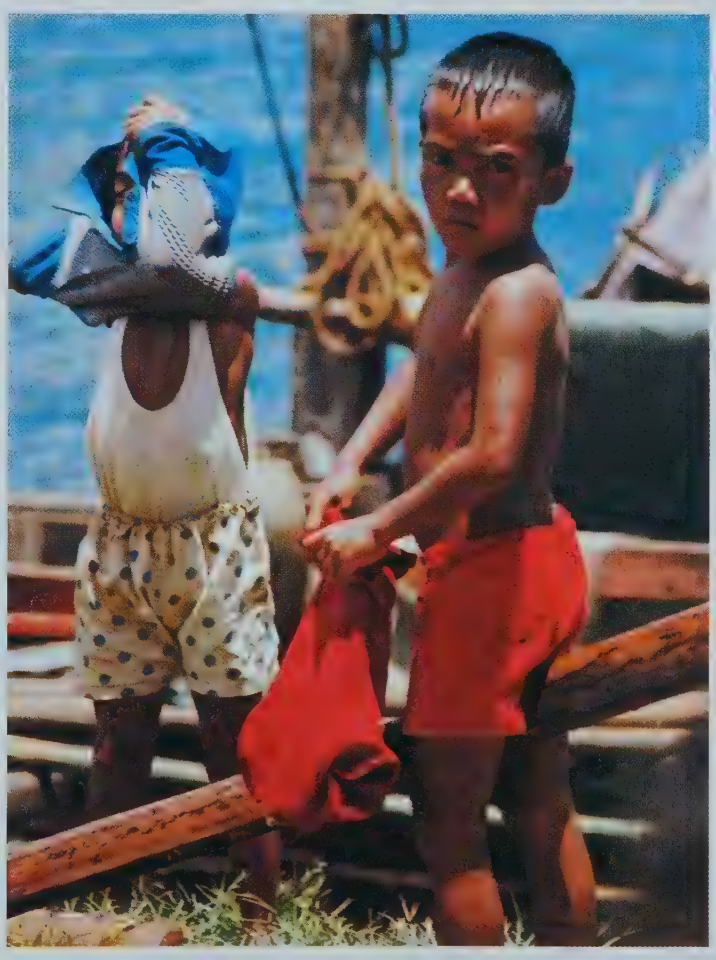
Lance Nelson, a well-known Australian magazine and industrial photographer, visited Sulawesi during the summer of 1970. A native of Brisbane, he now resides in Sydney.

S. Adolf Ratulangi was born in Manado, north Sulawesi, where he lived for 18 years prior to coming to the United States. In 1957 he joined the Embassy of Indonesia in Washington, D.C., as a clerk in the Political Division. Since January 1, 1966, he has been assisting the Press Attaché in translating, writing, and editing for INDONESIAN NEWS AND VIEWS, the Embassy's newsletter.
Photograph by Chase Photographers

A typical means of transportation on the Soroako River in southeastern Sulawesi is the perahu.

(Above) *Vendors display a variety of wares in a marketplace.*
(Below left) *People leaving a mosque after services on a Friday afternoon. The men are wearing the traditional* petji.
(Below right) *The ever-present sign of friendliness—a smile.*

(Left) *A village in a valley, with densely forested mountains in the background. Indonesian villages are never far from a river* (lower left).



(Above) *Houses in a typical village by the river are built on high bamboo stilts.*
(Below left) *A "stall" in a local market selling hot peppers.*
(Below right) *Reflections of joy on the faces of youngsters at play.*

(Left) *Women take time out for a friendly chat at the river's edge. While the older women wear the traditional* kebaja *and sarong, the younger girls wear Western dress.*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SHARING AN ANNIVERSARY OF PROGRESS

by ROBERT E. HINERMAN
Mayor of the City of Huntington

The City of Huntington is rich in history and bright in promise. For the veterans of the French and Indian War who first settled in the area, the accessibility to waterways and lush green hills and valleys meant a good life of hunting and fishing. Today, this same terrain provides pleasant surroundings for the city's nearly 75,000 residents—and the waterways have made Huntington one of the busiest river ports in the United States.

The 100-year-old city's potential for further growth is characterized in far-reaching concepts such as the urban renewal program now in motion. With 60 per cent of America's markets located within a 500-mile radius, the geographic location of Huntington has proved valuable to companies like International Nickel. For these firms, as for the city itself, the second 100 years seem to hold as much potential as did the first century.

Robert C. Byrd

United States Senator,
West Virginia

In the Ohio River Valley of West Virginia is the stately city of Huntington. A stranger passing through the city is quickly struck by an almost unique sense of urban spaciousness. The handsome parks, the wide streets, the plentitude of greenery, the overall neatness that meets the eye, reflect a strong and long-lived sense of community.

This year, Huntington is celebrating its centennial. Sharing the anniversary and celebrating one of its own is International Nickel's Huntington Alloy Products Division, a citizen industry that for fifty years has been an integral part of the life and growth of Huntington.

A City Is Born

Veterans of the French and Indian War first settled in this area about 1775. In the earliest years, pioneers gathered timber booms in great rafts about the mouth of the Guyandotte River, and for a time the region yielded thousands of animal skins. Nearly a hundred years later, the city itself came into being under the auspices of the man for whom it is named: Collis P. Huntington. His Central Pacific Railroad had barely been linked with the Union Pacific when Huntington turned his attention eastward to the Chesapeake & Ohio, a railway system being constructed between the Atlantic Ocean and the Ohio River.

Mayor Robert E. Hinerman, a native of Huntington, was educated in local public schools and graduated from Marshall University in 1942 with a Bachelor of Science degree in accounting and economics. Long active in civic affairs, Mr. Hinerman has been a member of the City Council since 1965. He is now serving his second term as Mayor of Huntington, having been selected for that office by his fellow Councilmen in 1965 and in 1969. He has been an employee of Inco's Huntington Alloy Products Division since 1941.

Under Huntington's direction, the C&O was reorganized in 1869. By 1870 he had selected a site for the western terminus of the railroad, and work began at both ends of the track. That winter the railroad magnate commissioned Rufus Cook to design and lay out the new city. Cook, a famous engineer from Boston, laid out some 5,000 acres nestled in the westward nook of the Guyandotte and Ohio rivers. The care-

"The city has much": (1) ***Churches*** *— the new Trinity Church of God;* (2) ***Hospitals*** *— the 280-bed Cabell-Huntington Hospital;* (3) ***Marshall University*** *— Smith Hall and Smith Music Hall;* (4) ***the highest tonnage volume of any inland river port in the United States*** *— a work scene on the Ohio River;* (5) ***parks and recreation areas*** *— some senior citizens playing croquet;* (6) ***an impressive County Courthouse;*** (7) ***Huntington Galleries*** *— the new wing by Walter Gropius;* (8) ***wide, tree-lined streets*** *— 3rd Avenue today.*

Huntington Alloys today: This 130-acre industrial complex is a far cry from the dusty corn patch of 50 years ago.

fully constructed grid pattern, with its many broad streets and wide avenues, was duly recorded and on February 27, 1871, the City of Huntington was granted her charter by the West Virginia Legislature.

An Abundance Of Resources

Today Huntington is a city mature in accomplishment but young in promise. At age 100, it can look back with satisfaction—with a sense of community achievement, and forward—with a sense of purpose, and the knowledge that today is the sum of what it has been, and the firm foundation for what it will become.

Much of Huntington's promise for the future remains her legacy from the past. These include the invisible but abundant underlying resources of the region: oil, salt, stone, sand, coal, clay, and gas, along with abundant water, timber, and transportation. Resources that are not tangible include a resilient spirit and unending resourcefulness.

The city has much. It is, for instance, a regional medical centre, with eight hospitals and nearly 3,000 beds. Marshall University provides a steady flow of young ideas and a host of highly specialized skills. Huntington also has a marvelous cultural centre in the Huntington Galleries, and it is well on its way to becoming the convention centre of a considerable transmountain region. Whether on the hills or in the valley, this is also a city of homes, and of more than 1,000 acres of city parks and recreation areas. It is a city that gives one a sense of spaciousness and calm amid much purposeful activity. Huntington is a city of churches—nearly a hundred of them—and of countless civic, cultural, and charitable organizations.

Continuing Economic Development

Construction activity in Huntington has been spectacular, with building permits doubling, tripling, and quadrupling in a three-year period. Huntington's trade area includes some 600,000 people, and retail sales are well over the two-thirds-billion-dollar mark in the area. Wholesaling has been established since pioneer days, and the city has been a financial centre since its founding. Some 75 per cent of the industrial firms in Huntington sell nationwide and 22 companies have international sales departments.

Local government in Huntington has provided the climate for continuing economic development in the area. The city operates under a city manager and mayor-council form of government, with joint city-county civic boards for recreation and health.

An Incomparable Site

Fifty brief years ago, when Huntington Alloys came to the city, Huntington was able to offer itself as an almost incomparable industrial site. A moderate climate and a touch of Southern serenity at first belie the fact that this city near the foothills of the Appalachian Mountains is also a key to the geographic reality of the Ohio River Valley. The city is closer to Chicago than to Atlanta, and no farther from New York than from Savannah. In a radius of 500 miles is contained 60 per cent of the nation's markets and over 50 per cent of its population.

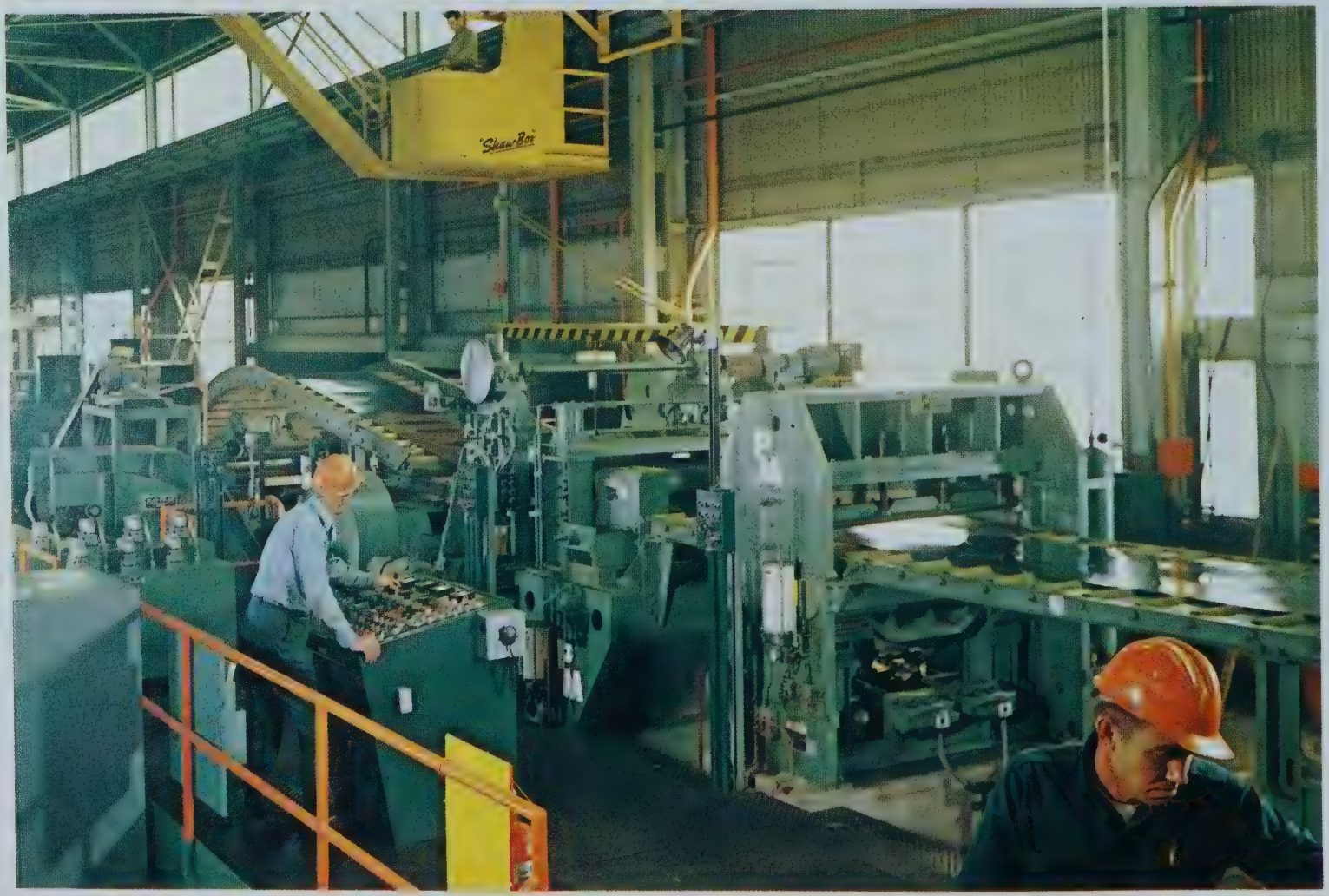
As Inco engineer W. L. Wotherspoon wrote in the 1920s soon after the new plant was built: "This territory covers the intensive manufacturing districts of the United States, with Chicago and St. Louis in the West, and New York and Philadelphia in the East. Huntington occupies a central geographic position in the territory and is also close to extensive natural resources, especially coal and natural gas."

Thirteen important railroads were connected within 175 miles of Huntington. And the Ohio River provided additional easy accessibility to extensive markets. Excellent labour, plentiful fuels, adequate power, first-rate transportation, equable climate, plentiful water and all needed supplies, a strategic location, and pleasant living conditions: Huntington offered them all, and in 1920 Inco found and purchased a 76-acre industrial site.

In A Dusty Corn Patch

With the end of World War I in 1918, Inco had launched a project to establish new markets for nickel and began searching for the best possible site for an anticipated refinery and rolling mill. The company set up a rigourous schedule of economic and environmental factors and spent two years conducting an intensive survey. Its search established Huntington as the clear choice. The new site, where a bumper crop of corn then grew, was bounded by the Guyandotte River within a mile of its junction with the Ohio, and was directly accessible to the Chesapeake & Ohio Railroad.

The following year, in March 1921, as the city celebrated its Golden Anniversary, ground was broken for the Huntington Works. A great productive plant rapidly took the place of a dusty corn patch. The new works started operations in May 1922, and by the end of the year production had reached 3,850,000 pounds. In 1923, the first full year of operation, production was up to


ShawBox

Now in the heart of downtown Huntington—3rd Avenue in 1884.

A city with a strategic location.

16,000,000 pounds. The new plant had cost $3.5 million, and the entire production during the first year was devoted to two products, Nickel 200 and MONEL® alloy 400, which remain today important members of the Division's product line.

As the city surged confidently into its second half century, the infant industry at first took hesitant steps as new men learned the intricacies of operating new machinery. But soon the people of Huntington found that the new industry was right in step with them.

A Major Industrial Citizen

Over the years, the product line has grown from two to more than fifty different nickel and high-nickel alloys produced in the largest mill complex in the world devoted exclusively to the production of such alloys. These products set the standard in industries that depend on them, and the world has watched Huntington products in action during such dramatic and historic happenings as Apollo 11's trip to the moon.

During this time, too, employment has grown from a few hundred to some 3,000. Huntington Alloy Products Division has earned its place as a major industrial citizen of Huntington. Today, 50 years removed from the dusty corn patch where it began, the Huntington Division pours about $40 million a year into the economic mainstream of the area, including nearly $30 million paid to employees in wages and salaries.

A 50th Anniversary is, after all, a special thing. And Huntington Alloy Products Division can take special pride in noting their growth and accomplishments during these years, a time of challenges met that holds forth promise of a bright future.

A Self-Renewing Society

For Huntington, this centennial year is also a time for taking stock. The men and women of the city are eager to preserve the machinery of their society that works so well here, a "family feeling" for one's own neighbours, neighbourhood, city, and region. Their values have been well tested. Yet theirs is a self-renewing society, ready to change where change is for the better.

The core area is ready for a change of that sort. A cleaning out and tearing down. A rebuilding. Private investors and the city plan just that, with renewal activity already underway. There is an expressed determination to create a city that continues to grow with the sort of planning that will make it an ever better place for people to live.

It has been in this city that Huntington Alloys has grown from a fledgling, experimental plant to become the major producer of specialized high-nickel alloys in the Free World. The Division has grown in an atmosphere of steadily developing and continuing accomplishment in Huntington, a city whose next hundred years are likely to be as bright as the Division's most highly polished product. As a corporate citizen, the Division is especially proud to carry the name of Huntington.

®International Nickel Trademark

Fifty years of progress: (Above) *Cleaning charcoal from annealed MONEL® nickel-copper alloy sheets—August 1922;* (Below) *The slit and cut line in the Strip Mill today.*

PICTURE CREDITS

Page 16: (1) Don Baker; (2) Eddie Lau; (3) *The Chief Justice*—Marshall University; (5) Nelson Paden; (6) H. D. McKeand; (7) Willis Cook; (8) R. E. Hinerman
Page 20 (bottom): Arthur d'Arazien
Page 21 (left): Courtesy of Cabell-Wayne Historical Society
(right): Map by John West

TO SOLVE AN AGE-OLD PROBLEM

Copper Development Association, Inc.

"Bottom-fouling" has for centuries been a mariner's curse. Hull-adhering barnacles, other marine growths, and corrosion damage have created costly problems of boat hull maintenance. Higher fuel bills, slower speeds, periodic scraping and painting, material deterioration—all have cut, often substantially, into the profits of the commercial boat owner.

To provide a permanent solution to this age-old problem, a unique copper-nickel-hulled shrimp boat has been developed by the copper and brass industry, in cooperation with International Nickel. The *Copper Mariner,* a 67-foot shrimp trawler, features a hull of 90 per cent copper and 10 per cent nickel. Copper-nickel was chosen for its inherent resistance to corrosion and to the various forms of marine life that attach themselves to a vessel's bottom.

The prototype boat is the nucleus of a four-year test program to demonstrate to marine operators the overall savings resulting from using a copper-nickel alloy as a hull material. Operating costs of the copper-nickel boat will be compared with sister ships launched at the same time, functioning out of the same port and in the same type of service, and built to identical specifications—except for the hull material. The unusually comprehensive test program will document maintenance cost savings through prevention of both marine growth and saltwater corrosion. The tests will also show the difference in fuel consumption resulting from bottom-fouling in intervals between haulouts.

Built at the port of Salina Cruz in Oaxaca, Mexico, the copper-nickel vessel will be operated under a test program as part of a commercial fishing fleet of shrimp trawlers based at San Juan del Sur, Nicaragua.


AGENCE ÉCONOMIQUE & FINANCIÈRE

LE NOUVEAU JOURNAL

The Toronto Telegram

AMERICAN METAL MARKET

Les Echos

News About INCO

Expect Increase In Nickel Sales

Free World Nickel Supply Tops Consumption in 1970

Nickel use at record high

Nickel : retour à un approvisionnement normal

LE MARCHE MONDIAL DU NICKEL EN 1970 ET SES PERSPECTIVES D'APRES INTERNATIONAL NICKEL

Free World consumption of primary nickel in 1970 is expected to be on the order of 955 million pounds, 111 million pounds over the 1969 figure and a record high, according to preliminary estimates by The International Nickel Company of Canada, Limited. The 1969 consumption figure is now established at 844 million pounds, 24 million pounds higher than the estimate made in December of last year.

Inco also estimated that about one billion pounds of primary nickel were available for consumption in 1970, which compares with 850 million pounds in 1969, when strikes resulted in a loss of production of some 150 million pounds. The small excess of nickel available over consumption reflects the partial restoration of working inventories, particularly in the last few months of the year.

PRIMARY NICKEL CONSUMPTION BY AREA

(Millions of Pounds)

Area	1970	1969
Western Europe (including U.K.)	390	327
United States	320	310
Japan	175	151
Canada	33	29
Latin America	7	6
Other Free World Countries	30	21
	955	844

PRIMARY NICKEL CONSUMPTION BY NICKEL-CONTAINING PRODUCTS

(Millions of Pounds)

Nickel-Containing Product	1970 Pounds	1970 %	1969 Pounds	1969 %
Stainless Steels	395	41	345	41
High-Nickel Alloys	133	14	119	14
Nickel Plating	125	13	109	13
Constructional Alloy Steels	105	11	101	12
Iron & Steel Castings	83	9	70	8
Copper & Brass Products	34	4	28	3
All Others	80	8	72	9
	955	100%	844	100%

ESTIMATED NICKEL CONSUMPTION: 1970

End-Use Markets	Per Cent Of Total
Consumer Products	16
Machinery & Transportation	14
Automotive	12
Electronic	9
Chemical Industry	8
Petroleum Industry	8
Process Industries	7
Aircraft	6
Energy Conversion Systems	4
Marine Industries	3
Architecture	3
Coinage	2
Others	8
	100


NICKEL
PLATED
FALL IN! FALL IN! FALL IN
RECRUITS WANTED
$4.50
TAKES CARTRIDGE
No. GR24
GENUINE
SMITH & WESSON REVOLVERS.
DEAD OR ALIVE
REWARD
BUTCH CASSIDY
SAT MASTERSON
FRANK and JESSE JAMES GANG
Good Intent Line
OF COACHES.
KALAMAZOO, BATTLE CREEK & GRAND RAPIDS.
DIRECT TO NEVADA!
DAILY STAGES
COACHES!

THE HERITAGE OF NICKELED AMERICAN FIREARMS

by E. DIXON LARSON

The nickel plating of American firearms can be researched back to January of 1872. This was some 36 years after Sam Colt's first conception of a practical revolving cylinder pistol—a development that was to give one man the firepower of six. Some say, "The Lord created men, but Sam Colt made them equal."

Acceptance of the percussion revolver was slow. After all, the single shot had been the accepted means of defense for some 300 years. To promote his "revolver," Sam Colt travelled throughout the world, presenting royalty with exquisite custom models, inlaid with gold or plated with silver. Some of these models were engraved by such famous New York City engravers as W. Ormsby, L. D. Nimschke, and Joseph Wolf.

Tiffany Colts

The custom of giving presentation swords as tokens of esteem seems to have been practiced for many years prior to this in England and on the Continent. Most such weapons were the product of French artistry, using silver and gold as the shiny medium. The Civil War brought in an era of presentation arms and swords that was the highwater mark of baroque adornment. Charles Lewis Tiffany had founded and organized his outfitting company in 1837, establishing a Paris branch in 1853, known as Tiffany, Reed and Company. It is not hard to understand how the talented designs of Boutet found their way into the United States in the 1860s. By this time, Tiffany and Company was located at 550 Broadway, New York City, and doing very well as outfitters for Civil War and custom presentation pieces.

It was during this period that President Lincoln ordered John Quincy Adams Ward to design a presentation grip for a brace of Colt pistols to be presented to the Governor of Turkey for his service in saving the family of the Reverend Phillip Merriman, when Merriman himself was killed by highwaymen of that country. The "Tiffany Colts" were engraved profusely, equipped with one-piece cast ornate bronze grips, and then silver plated. One wonders whether this was a weapon or a piece of jewellery. Regardless, Tiffany Colts are very beautiful and today command a tremendous price—from $3,500 to $11,000. When John Orr was imported into the Tiffany firm, we find the first evidence of nickel finishing, replacing some of the customary silver over the engraving, which was to become much more common in the mid-70s.

Tools Of Survival

At the close of the Civil War, the Colt Company was left with an inventory of many percussion (cap and ball) parts. There were no military issued cartridge weapons in the Civil War but at its close Colt's management was preparing to market a cartridge revolver. In an effort to reduce costs and utilize the inventory of parts, Mason and Richards of the Colt Company patented a method of converting the percussion revolvers to fire a metallic cartridge. Three basic models were made up at the factory as cartridge weapons from the percussion parts. These revolvers were placed on the market in the hope that they would be rapidly purchased by those who recognized the convenience of the metallic cartridge. But many percussion weapons were in the hands of soldiers who had returned to civilian life; as their means would not afford them a new-type weapon, sales were slow.

In 1872 the Colt Company started nickel plating the converted models for sales to Mexico. Advertising described these weapons as "resistant to corrosion." The Mexican market proved a fertile field for sales of the "shiny guns." Simultaneously, as the inventory of conversion parts diminished, a new model, the "Frontier Model of 1872" was released. This was the first Colt basic cartridge model. Its finish was predominantly in nickel. Finish could not be specifically factory ordered at this time, and customer cost was the same for nickel or blued iron. Most of the nickel guns were shipped to the West or Southwest and to Mexico, to markets where weapons were still being considered as tools of the trade of survival.

For The Indian Scouts

In the Yellowstone Campaign of 1874, Lieutenant Colonel George Custer was equipped with the first Army-purchased Colt Single-Action Army revolvers. The Army, experimenting with corrosion-resistant finishes, issued nickel-plated models to the 42 Indian Scouts with Custer in this campaign. It is believed that this resulted from two considerations: First, the Indians had an aversion to pistols due to the complicated removal of the spent cartridges; therefore the "shiny nickel" might make them more readily acceptable. Second, the nickel finish was much more resistant to rust than the customary blued iron, and could withstand more abuse from the lack of preventive maintenance which

CREDITS

Three-dimensional collage by Abe Gurvin
Photographs by Eddie Lau, Inco, Inc.


ORDNANCE
INSTRUCTION BOOK
G.A.R.
IN MEMORIAM
AMERICAN ARITHMETIC

could be anticipated from the Indian Scouts. All of these guns were issued prior to serial number 15,000. Inasmuch as the Colt records of serial numbers below 30,000 were destroyed by fire, the X-ray spectrometer and the microprojector must be used to determine original nickel-finish on "U.S." early marked cavalry guns.

At this time Lieutenant Colonel George Schofield was busily trying to promote Army acceptance of his "improved" Smith & Wesson Army Model with the break barrel. The first Schofield Models were delivered to the Army in 1875, a year late of the contract date. Some 8,285 models were produced. Here again, the scarcer ones are in the nickel-finish. In observing the pieces that have survived, it is obvious that the nickel-plated models seem to have withstood the ravages of time better than the blued ones. Sadly, and without much acknowledgement, Lieutenant Colonel Schofield, disappointed at having failed to promote his new model, committed suicide December 19, 1882, on a Sunday morning at Fort Apache, using one of his nickeled "Schofield" revolvers.

As commander of the 6th Cavalry, Schofield was a "competitor" of Custer. Interestingly enough, he tried to persuade Custer to equip his 7th Cavalry troops with the new model. Many of the historians who still "relive" the Custer massacre at the Little Big Horn speculate as to what the difference would have been if Custer had taken the "Schofield." It can be loaded and unloaded with one hand, whereas the Colt Army Model requires both hands and takes considerably more time and precision in alignment.

Gun Fighters And Head Slappers

Lawmen and outlaws have always been associated with nickel-plated guns, a fast horse, and a good saloon. Research shows that between the years 1860 and 1884, Wells Fargo lost $917,726.55 in 347 stagecoach and eight train holdups. The last of the bandit riders was "Butch" Cassidy, born LeRoy Parker of Mormon parents in Circleville, Utah. Butch wasn't a gunfighter; he had staff associates like Matt Warner and Harvey Logan for such tasks. Warner's life story mentions his 4¾-inch Colt Single-Action 44-40 with a nickel finish (Serial No. 70,367). Colt factory records show that it was ordered in 1881 with nickel finish. Factory nickel finish became available at the Colt factory on special order in 1877, although the finish had been used extensively prior to this date.

Cassidy, who had no talent for gunfighting, favoured an 1875 Remington Frontier Model with the 7½-inch barrel, nickel finished. The shape of the Remington is flatter and lends itself better to use as a "head slapper." Cassidy continually reminded his confederates that it was much better to break a man's nose with the gun's barrel than to shoot him. Early Remington models were predominantly nickel finished. Remington exported several thousand models to Turkey with the finish in corrosion resistant nickel.

Bat Masterson, the lawman and saloon keeper ordered a total of seven Colts

(Above) *Factory nickel finish was used for the first time on the Colt Conversion of the 1851 Navy Model.*

(Left) *The Colt Tiffany Cartridge Conversion of the 1860 Army Model in the true "Tiffany" fashion of nickeling the engraved portion and silver plating the grips, which show a North-South battle scene.*


VIL CASES
JUSTICE'S DOCKET
IN THE JUSTICE'S COURT OF MAMMOTH
Juab County
VS.
ATTOR
sum of
cause be dismissed, and that plain-
(b) Plaintiff have and re-
and costs herein taxed at $
per cent. per
Justice of the Peace
Note.—Where judgment is rendered on the default of defendant, one or more witnesses should be sworn
and examined on the part of the plaintiff and docket must so show

from the factory between the years 1879 and 1885. The first one was silver plated, thereafter all but one were nickeled.

Suicide Specials

In 1900, when the Colt and Smith & Wesson companies' patents expired, it was legal for any manufacturer that could scrape together enough machinery to fabricate a revolver of any design. Thus the "Suicide Special" was born. By definition, the "Suicide Specials" are unique in that they have almost no historical significance: They never won any battles (with the exception of an occasional Saturday night brawl), nor had they any part in the winning of any frontier. Their only purpose was to provide a gun-toting era with a concealable armament at the least possible cost. Nickel-finish technology had improved, making it cheaper, as all 1909 catalogues indicated, by $1.00 than blued.

From 1909 to 1911, before the enactment of the "granddaddy" of all U.S. anti-firearms bills, the Sullivan Law, in 1911, some of the old ads would horrify supporters of today's anti-gun legislation. The naive claims made by others would probably make today's knowledgeable firearm user chuckle. For example, in 1909, the Savage Arms ad read, "Unbelievable quickness gets in the first burglar finishing shot." Also offered was a free booklet of encouragement by the great Bat Masterson entitled, "The Tenderfoot's Turn." Many ads show that nickel was now a low-cost process—cheaper than blue finish—not to mention the fact that nickel covered the surface flaws. Such firms as Iver Johnson stated, "Richly Nickeled" at $6.00. Currently, nickel-finished arms can be ordered at a premium of about 10 per cent.

Acknowledged as one of the outstanding judges of antique weapons at the nation's leading gun shows, E. Dixon Larson is well known as an author for several leading gun magazines. Professionally, he has held various engineering positions with the United States Steel Corporation over the past 25 years and is at present Supervisor of Fuel Engineering. He makes his home in Orem, Utah.

(Above) *The Colt Single-Action Army Model, nickel finish, "U.S." Custer Indian Scout issue.*

(Left) *Matt Warner's 4¾-inch Colt Single-Action 44-40 calibre, one of the first gunfighter guns ordered with nickel finish.*

MUNICH:
AN INTEGRATED TRANSPORT SYSTEM

by KLAUS ZIMNIOK

Munich's problems are typical; its solutions are not. All over the Western world, urban complexes—and especially the older cities—are facing strangulation. To spend an hour in a traffic jam—or to cross the Atlantic in six hours and then to spend another hour (or more) in moving the few miles between airport and city centre—may lead one to despair. Munich, however, did not despair, coming up instead with solutions interesting to harassed travellers and commuters all over the world. Dr. Klaus Zimniok, who has had much to do with these solutions, speaks at firsthand.

"No, thanks, I'm in a hurry; I'd rather walk." An unusual answer—from a pedestrian to a friend who had offered him a lift in his car? Not in most large cities in Europe and North America today. And it is certainly true in Munich.

Of all the German cities with over 500,000 inhabitants, Munich, capital of Bavaria, has experienced the greatest increase in population. Between 1950 and 1960 the population increased by almost one-third, from 850,000 to 1,000,000; from 1956 to 1960 there was an increase of 3.7 per cent or about 35,000-40,000 persons; and in 1968 the population increase reached a new record of 48,000. Now the population of Munich is approaching the 1.4-million mark.

Munich's favourable geographical position, together with its excellent recreational facilities, the concentration of cultural, scientific, and economic institutions in the area, and excellent opportunities for the individual, brought about this "population avalanche." The number of jobs has increased even more sharply, mainly as a result of changes in the structure of the secondary and tertiary economic sectors.

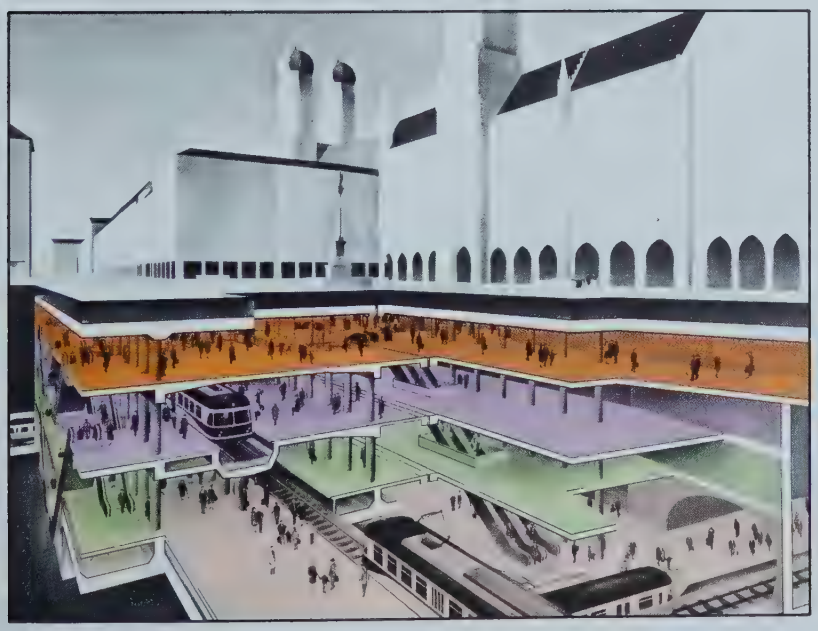
Despite all efforts, traffic conditions have deteriorated rapidly. By the end of 1969 there were about 365,500 motor vehicles on Munich's roads, not including postal, railway, and military vehicles. For years, private and public transport have been causing each other increasing difficulties. The speed of tramcars at times amounts to only 13 kilometres (8 miles) per hour, and in the city centre, during rush-hour periods, it drops to between 4 and 6 kilometres (2 and 3 miles) per hour! Motor vehicles run at speeds one would associate with the age of the horse and carriage.

Studies indicate that the population of the entire Munich area will increase to 2 million by 1975 and to between 2.8 and 3 million by 1990. About half of these people will live in the city itself. The number of jobs in the city should by then amount to about one million and to another 470,000 in the surrounding area. By 1990 the number of motor vehicles will have risen to between 290 and 340 per thousand inhabitants, so there will be one vehicle for every three inhabitants. At the end of 1969 the ratio was one vehicle to every 3.8 persons.

This concentration means that the individual will experience major changes in his environment. Apart from the ever-increasing distance between his home and place of work, and the increased time taken to cover that distance, the problems of noise-nuisance and air and water pollution in a densely populated area such as Munich can no longer be disregarded. For decades and centuries our towns expanded without being planned; they "overspilled;" and often people failed to see that the time had come for such uncontrolled "natural" growth to be checked.

Organization and Integration

A dynamic city like Munich must check such uncontrolled development by means of clear plans for reorganization.



This rendering shows cut-away sections of the Marienplatz construction.

Charged with achieving an efficient public transport network in time for the 1972 Olympics, Dr. Klaus Zimniok was recruited by the Lord Mayor of Munich to solve the city's traffic problems; since 1966 he has been consultant for the Munich underground railway system and director of other related building projects. In addition to his work as a town councillor, he is a college lecturer and author of over 100 publications. His major works include the six-volume *Investigation into the Development of Public Transport Facilities in Munich.*

After exhaustive study by municipal officials, and advice from noted city planners and traffic experts, a development plan was devised and, in 1963, was accepted by the Munich Town Council. Primary was the decision that the basic structure of the city and the surrounding area will be preserved. Working on the basis of this structure and taking into account predicted future developments, the city and region are to be arranged into a series of units—areas immediately bordering the city and outer areas—grouped in segments around the city centre but separated by open spaces. Each resulting complex should carry out the everyday functions of a town; it should have its own economic and cultural centre while at the same time being related to the city centre. Plans have been made to intensify building in the outer areas, spreading outwards along the public transport routes in star formation to avoid merging with the surrounding countryside.

The distances that have to be covered between home and work demand that specific arrangements be made for the various forms of transport in and around the town. Pedestrians are to have their own zones. In addition, it is considered essential that recreation areas in the form of open spaces be provided within the city, which would at the same time be an integrating factor in the organization of the individual complexes.

A vital part of the reorganization is the integrated transport plan, which is to coordinate travel by air, rail, local public services, and private transport. It will thus help to maintain the vitality of the "city organism."

Munich is surrounded by six airfields, only one of which, Munich-Riem, handles civil air traffic. Although near the city centre, this airport has two main disadvantages: The height of buildings along the flying lanes is severely limited, and the noise-nuisance to residents is increasing with today's larger airplanes. The decision to build a new airport at Erdinger Moos, some 35 kilometres (22 miles) north of Munich, has been doubly welcomed; it will be at a reasonable distance from the city yet have relatively easy access to road and rail transport, and will release a large area in the south-east for the development of an overspill town, "Neu-Perlach," in which 80,000 people will live.

Public Transport Versus Private Transport

Essential to the integrated transport plan is the immediate establishment of an efficient public transport system, with the aim of redressing the balance between public and private transport. In 1968, only 44 per cent of the population travelled on public transport, the remainder using private vehicles. But by 1990 the ratio should be 65 per cent to 35 per cent. Our roads will then be clearer, thanks to more efficient public transport facilities. For example, a subway train with six coaches will carry an average load of 1,000 people. Four trolleys or twelve to fifteen buses can transport the same load. But to carry the same number of people, 700 private cars would have to be on the road and if each moving car requires, on average, about 40 square metres (430 square feet) of space, then 28,000 square metres (300,000 square feet) of our precious roads are being occupied. It is the aim of the plan to concentrate public transport mainly in the built-up areas, while in the open, less built-up areas private transport can be used more freely.

The suburban railway lines, which converge radially on the city, will be connected by a 4.2-kilometre (2½-mile) tunnel between the Hauptbahnhof, in the centre, and the Ostbahnhof, and the public transport network within the city has been designed to coordinate with this. Thus the suburban network of the German Federal Railways, which will become the Metropolitan Line, will be drawn into Munich's local transport system. By their coordination with the city's north-south public transport facilities, an efficient interchange of traffic will rapidly be achieved.

In 1963, after extensive study, Munich decided that, for the part of the public transport network which came under municipal control, a completely separate underground railway should be developed, independent of all forms of transport on other levels. After the completion in 1972 of the first stage of the subway network, the remaining tram routes will be retained and divided into four groups, enclosing the city centre in the form of a rectangle. When the entire subway network has been completed, some of these tram routes will still be retained. This, however, does not rule out the possibility of building an underground circle line later on. The system of bus routes will be kept flexible and, according to building progress, will be connected to the present termini and intersection points of the underground railway and the Metropolitan railway routes.

The capacity of the city's public transport network when complete will be about 300,000 passengers per hour, as against 100,000 at the present time. The combined underground tunnel system will comprise about 40 kilometres (25 miles) of tunnel.

Road Development

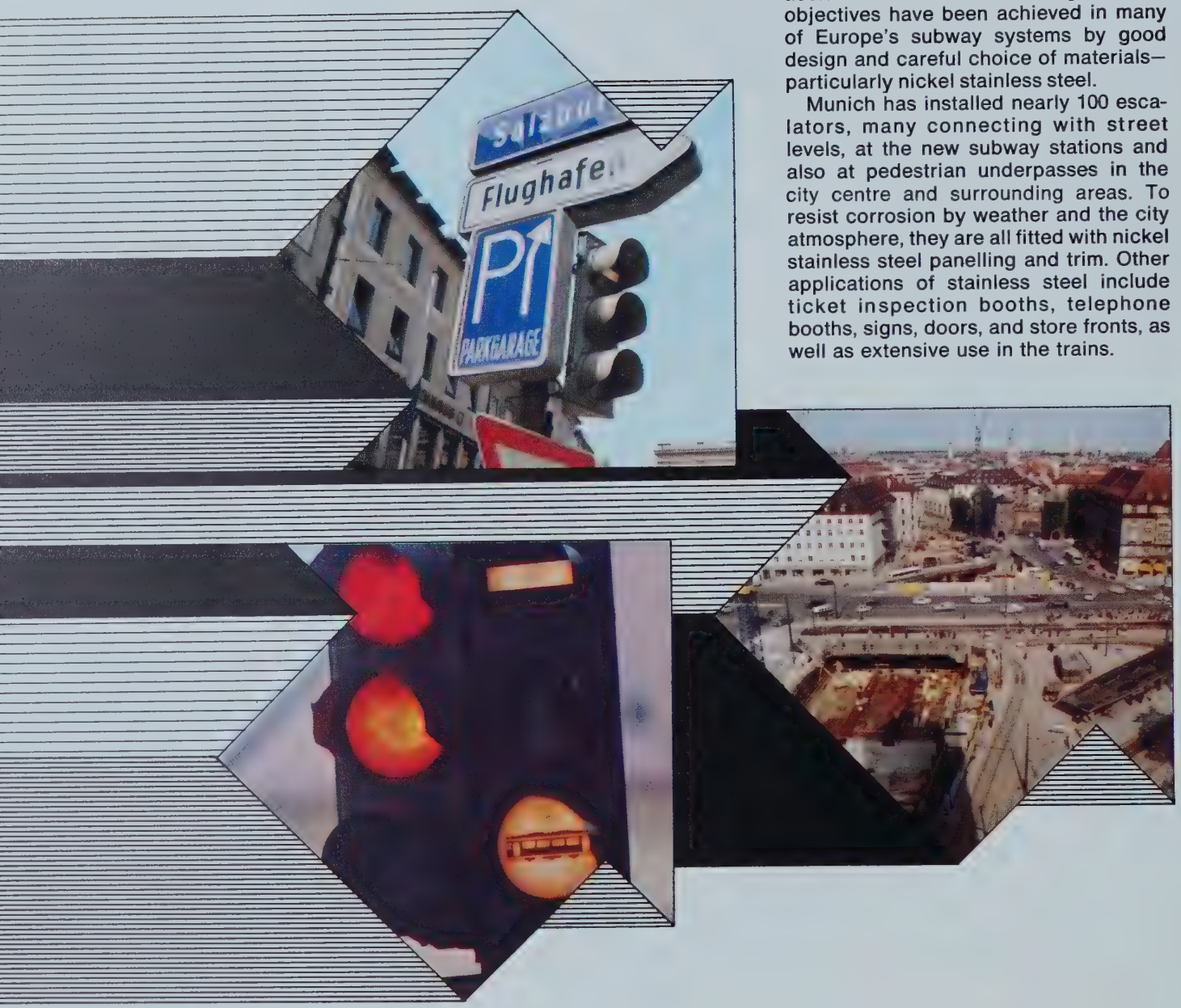
By the end of the planned period a system of three ring roads will be available to private transport, supplemented by tangential roads and overlapped by interconnecting urban expressways, which will link up directly with the four existing autobahns (to and from Stuttgart, Nuremberg, Salzburg, and Lindau).

The old city ringway is intended to keep private transport away from the inner city area to a great extent and to

NICKEL: A VITAL MATERIAL

Equipment used in modern mass transportation systems—especially items with which the public comes into physical contact—must be highly functional in design, reliable in operation, and resistant to both accidental and wilful damage. These objectives have been achieved in many of Europe's subway systems by good design and careful choice of materials—particularly nickel stainless steel.

Munich has installed nearly 100 escalators, many connecting with street levels, at the new subway stations and also at pedestrian underpasses in the city centre and surrounding areas. To resist corrosion by weather and the city atmosphere, they are all fitted with nickel stainless steel panelling and trim. Other applications of stainless steel include ticket inspection booths, telephone booths, signs, doors, and store fronts, as well as extensive use in the trains.



carry traffic from the Federal highways. A rectangle of tangential routes, supporting the old city ringway, will carry out the same functions over a larger area, and will link up neighbouring districts. The middle ringway is a series of tangents linking the outer districts; at the moment it also has to serve as an inner link for the autobahns.

Finally there is the outer trunk road ringway which will run partly outside the town. As yet it can only be regarded as a suggested system. Later on it will provide an effective by-pass around the town for the increasing long-distance traffic. The Federal highways and State highways, which run radially through the town, supplement as necessary the ringways and tangential routes.

Reduced Parking

Stationary vehicles are also taken into consideration in the integrated transport plan. As a result of a traffic survey in 1961, it has been decided that the number of available parking spaces should be adjusted to the capacity of the road system, and should not exceed 70,000 for the whole of the city area. Many spaces are to be restricted to short-period parking, which will spread private traffic out evenly over the day, and reduce the problems caused by long-term parking at peak traffic times.

Within the old city ringway a system of pedestrian zones will help preserve the character of the city centre. The Neuhauser-Kaufingerstrasse roadway between Karlsplatz (Stachus) and Marienplatz is also to be used exclusively by pedestrians. A city-planning competition produced some good suggestions for these pedestrian areas.

Attractive Public Transport

Concurrent with the development of the integrated traffic system, considerable effort is being made to make public transport more attractive to the local population. Emphasis is being laid on speed and safety, wide and comfortable cars, and well-equipped, attractive stations with widespread use of escalators. To facilitate easy changing from one form of transport to another, the passenger should be given the opportunity to use the same ticket for all transport. However, there are several problems, particularly concerning the cost, which can only be solved by means of a traffic and fares association similar to the one in Hamburg. A Munich traffic association, consisting of representatives of the State of Bavaria, the German Federal Railways, and the City of Munich, is being organized to solve this problem. It has already been proved that the German Federal Railways and the City of Munich alone cannot, for financial reasons, form an association to operate outside the city boundaries as well. The participation of the State of Bavaria and the German Federal Republic is therefore essential.

The various public transport facilities are to be linked together at focal points. This is essential for the construction of the combined system and also contributes to its overall attractiveness. Trolley routes and bus routes, supplying the underground and metropolitan railway network, will be linked to the "park-and-ride" facilities on this network. Examples of this are the underground stations *Olympiastadion, Scheideplatz, Munchener Freiheit, Sendinger-Tor-Platz,* and *Am-Harras,* and the metropolitan railway stops *Pasing* and *Ostbahnhof,* where the traveller can park his car and continue the journey by public transport. In addition, underground intersection points—such as the underground and metropolitan station at Marienplatz, in the heart of Munich, the Stachus development under the busiest traffic area in Europe, and the interchange of the underground and metropolitan railways at the Hauptbahnhof—will help alleviate congestion. Car parks along the old ringway around the city centre are also included in the integrated transport plan. Parking space for 800 cars will be available at the Stachus development on the third and fourth levels underground.

The Immediate Aim: Olympiad

With the 1972 Olympics now less than a year away, great effort is being made to complete several miles of new underground railway before the expected arrival of thousands of visitors. A new 16-kilometre (10-mile) line will run from the north to the south of Munich; a 4.2-kilometre (2½-mile) tunnel running east to west will join up the suburban railways, and the new "Olympic" line will transport visitors to the stadium from the city centre. The two new stretches of underground railway will require an expenditure of about 850,000,000 DM ($230,000,000).

In order to carry out this vast building program efficiently, the municipal development plan has been divided into a series of short projects with limited time periods, which can be supervised more easily. This leads to the "Mehresjahres" investment programs, in which money is invested in the individual building projects in order of importance for three or four years. To date, the following important projects have been undertaken: the further development of a network of efficient public transport facilities connected by railways, the completion of the middle ringway and the old city ringway roads, and the building of parking facilities on the outskirts of the old city.

We in Munich hope that we have done, and are doing, everything humanly possible to aid the efficient flow of traffic in our city. This problem is the cause of many headaches, here and all over the world. Only the future will show whether we have succeeded.

PICTURE CREDITS

Pages 30, 32 (top right, bottom), 34: Friedrich Rauch, Munich
Page 31 (drawing): Munich U-Bahn Referat
(author's photo): Georg Mikes, Vienna
Page 32 (top left): H. J. Conda

A wide range of activities—a financial analysis course and (below) *an explanation of monitoring equipment in the instrument shop.*

OBJECTIVE: EMPLOYEE SELF-DEVELOPMENT

From supervisory leadership to instrument training, from interpretation of the Ontario Mining Act to first aid, from industrial relations to new employee orientation—the working and planned syllabus has continued to expand since Inco's Training and Development Institute in Sudbury, Ontario, opened its doors late last fall. The Institute is geared to the company's objective of providing employees with training and development assistance to enhance their opportunities for advancement, by preparing them for promotions from within International Nickel.

Modern as the methods used in its instructional programs, the Institute's new quarters include six large functional lecture rooms, a 76-seat tiered theatre, offices and a board room, a reference library, and a fully equipped instrument training shop.

The range of instruction is indicated by five programs now in progress. In one, succeeding groups of 12 trainees drawn from a broad cross-section of company staff employees attend, once weekly for five consecutive weeks, four courses in management-supervisory training. In another, 40 trainees enrolled in a 48-week intensive instrument maintenance program rotate between two weeks at the Institute in lecture sessions and the fully equipped workshop, and two weeks of on-the-job training at mines and plants.

Photographs by Clive Webster

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A New Era In High-Speed Analysis

The most advanced analytical instrument in the world—capable of doing in minutes what previously took hours, days, or even weeks—has been installed at the Birmingham Research Laboratory of International Nickel in England. The instrument, a computerized X-ray fluorescence spectrometer, should benefit a wide range of industries for it will shorten the time involved in the development of new alloys essential for technological progress.

It represents a new era in high-speed physical methods of analysis. For the first time, almost instant analysis of experimental alloys of unknown composition is made possible. Previously, such analysis could involve many, many manhours of painstaking work.

Before the introduction of computerization, X-ray spectrometers worked on the comparison principle, determining the composition of an alloy by comparing it with a reference sample of similar and pre-analyzed composition. This severely restricted their usefulness in alloy research work, where original alloys are being created that may differ substantially from any existing alloy and for which, at the time of their initial production, no reference sample exists.

This restriction is swept away by the new instrument. Original alloys can now be analyzed just as quickly and conveniently as established ones and so research work will be able to move ahead more rapidly.

To achieve this sophisticated performance, the computer had to be programmed with data gained from studying large numbers of sample alloys, and with information drawn from Inco's development programs on new materials over the past 40 years. Without that fund of specialized knowledge, it would not have been possible to create this unique analytical facility. A team of Inco scientists spent two years preparing and collating the data, working in close collaboration with the makers of the spectrometer—The Philips Company of Eindhoven, Holland.

PICTURE CREDITS

(Left) Paul Garland, Inco Limited
(Right) R. Maynard-Smith, Inco Limited

INTERNATIONAL NICKEL

MAGAZINE

1971/4

The Cover

"Nickel... its contribution is quality" has long been a widely known industrial adage.

The manufacturers of the containers lining the decks of the *Dart America* as she set sail on a voyage from Antwerp, Belgium, to Southampton, England, had this in mind when they chose nickel stainless steel and other nickel-containing materials for critical container components. So, too, did the builders of the specially designed vessel itself. In fact, the technology of materials, as well as the technology of design and conglomeration, is playing a critical role in *The Great Containership Race* (page 12).

Powders would seem a far cry from stainless steel in ships or containers. *On The Frontiers Of Engineering* (page 30), however, nickel is making other valuable contributions in another key area—the exciting world of powder metallurgy.

But nickel is not simply strong, corrosion-resistant, and malleable. It contributes greatly to one of man's most deep-seated psychological traits—a love of bright things. Jon Tinker's *The Magpie In Man* (page 2) investigates this human quality—one found elsewhere in the animal and plant kingdoms. Whether in a stainless steel coffeepot, or the nickel-chromium brightwork on an automobile, or one of a multitude of other *Facets Of Brightness* (page 8), nickel is again a critical component.

Increasingly, one can modify the old adage. Today, "Nickel... its contribution is versatility."

Cover photograph by R. Maynard-Smith

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THE MAGPIE IN MAN

by JON TINKER

Deep in Man's collective unconscious is a need for brightness, an innate craving that goes back through the Stone Age to the beginnings of time. This love of glitter is not confined to Man. In English folklore, the magpie is renowned for its thieving habits, being particularly prone to steal anything bright. The magpie was first recorded as long ago as A.D. 998 by an Anglo-Saxon, Aelfric the Grammarian, and in those days it was a familiar sight around a peasant's wattle-and-daub hut. Anything missing, provided it was bright and shiny, would, as like as not, turn up in the magpie's nest, where there was often an incongruous collection of bits of glass, white stones, shells, and bones, together with an occasional small knife, bracelet, or jewel. Today, probably as a result of ruthless persecution by gamekeepers in the 18th and 19th centuries, the magpie keeps its distance from Man and is known as a noisy chatterer rather than a collector of bright things.

The magpie, though, is only occasionally overcome by an urge for brightness. More remarkable are the male bower-birds of Australia and New Guinea, which regularly build small tents from twigs stuck in the ground, filling them with brilliantly colored objects. According to the 19th century Italian naturalist Beccari, the gardener bower-bird lays inside his bower "a bed of verdant moss, bedecked with blossoms and berries of the brightest colors...". Another bower-bird is especially fond of blue objects, collecting parrot feathers, blue grass, china, bits of paper, and even blue bags stolen from nearby kitchens. Some bower-birds paint the insides of their bowers with fruit pulp; others steal the contents of their neighbors' bowers. But they all want a bright bower, for it is there that mating takes place.

Enthusiasm for bright objects: the magpie

The bower-bird collects bright flowers or shiny and colorful objects to decorate its bower, or nest, in the mating season.

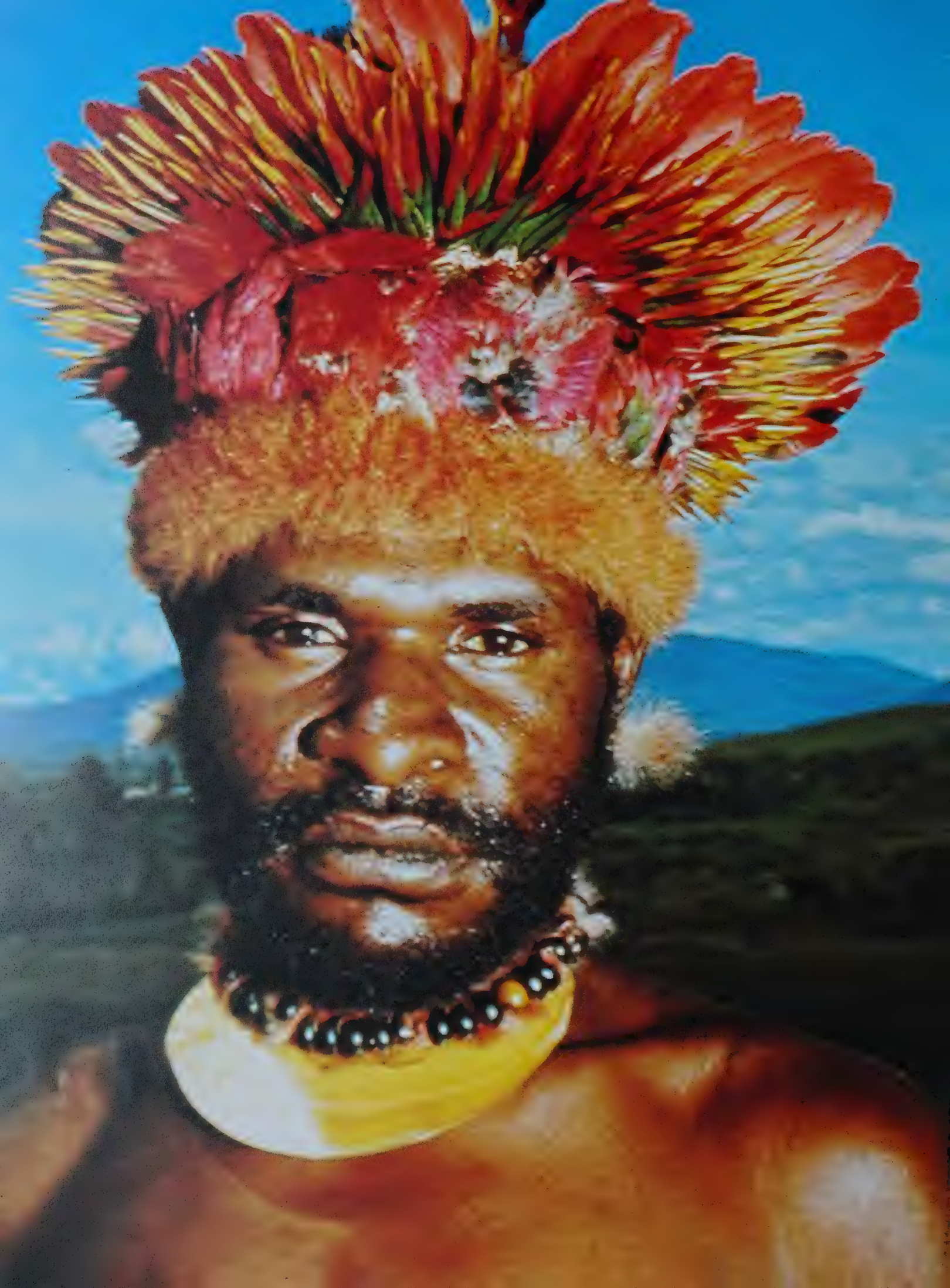
Some creatures use brightness for defense: this Peacock Butterfly tries to frighten off predatory birds by flashing the bright "eyes" on its wings.

In Fear And Love

Brightness plays an important part in the lives of many groups of animals. The firefly and the glow-worm probably emit light to attract a mate. The purpose of certain lantern fish is more sinister: an elongated spine from the dorsal fin acts as a fishing rod, dangling its glowing tip in front of the fish's mouth. Smaller inhabitants of the sea's sunless depths go for this brilliant bait, and are gobbled up as a result.

A predatory beast or snake can sometimes mesmerize a bird sitting on its nest by staring steadily while slowly advancing. A sudden movement and the bird will fly off, but the relentless advance of a glowing eye seems to induce paralysis. In Man, a similar inherited fear may well be at the root of hypnosis, the patient being immobilized by the racial memory of a ferocious sabertooth, eyes staring redly into the firelight. Most animals are disconcerted by the sudden appearance of an eye, which is probably the reason why the eyed hawkmoth has an eye-like design on its lower pair of wings. Flashed at a bird about to peck it up, the hawkmoth's "eyes" can save its life. The same trick is played by baby rustyheaded cuckoos in Madagascar, which scare off predators by opening wide their mouths. Two white staring "eyes" and a vivid white "mouth" stare out from inside the dark black throat.

In most birds, though, it is the plumage which shows the brilliance of color and contrast. Birds use their feathers for display, both to attract mates and to frighten off rivals. Birds often seem torn between developing a bright, rival-scaring, mate-attracting plumage and a dowdy, camouflaged, hawk-avoiding dress. This has led to sexual dimorphism, where the male has the gaudy feathers and the fe-



Brightly colored feathers and flowers adorn the headdress of this New Guinea tribesman.

male the cryptic coloration. Occasionally, the opposite applies: in the phalaropes—small, sandpiper-like birds from the Arctic—the males are soberly attired in grays and browns, leaving the females to bedazzle one another with brilliant red, black, and white neck patterns. It is no coincidence that in sexual ritual the female phalarope is dominant—and she mates with several males.

Surrounding Himself With Brightness

Man, in his love-hate relationship with brightness, is an animal first and foremost. Our nearest relatives, the apes, develop brilliant red and blue rumps in the mating season. Lacking such inbuilt magnificence, we have taken on the habits of the magpie, collecting about our person and in our homes the glinting splendor we need to establish our status, awe our rivals, and dazzle our mates.

We cannot know exactly how our remotest ancestors half a million years ago expressed this need for brightness, but they probably employed some of the methods used by contemporary Stone Age cultures such as the natives of New Guinea. As well as decorating themselves with boars' teeth, colored clay, and mother-of-pearl shells, they make elaborate headdresses from the most magnificent of all jungle creatures, birds of paradise. In East Africa, more advanced cultures behave rather similarly. The Turkana warriors of the Rift Valley, for example, wear leopard capes and ostrich plumes, with ivory plugs inserted under their lower lips, while the women have a short leather skirt held in place by a wide belt of beads. Traditionally, these were cut from the soft, pale local stone, but now a more dramatic result is achieved with aluminum salvaged from melted saucepans.

The first historical expressions of brightness which archaeologists have found are those of our neolithic forbears, 20,000 or so years ago. Their cave paintings of bison and mammoths were drawn in brilliant reds and browns not only to reflect the firelight but to inspire the next day's chase.

But it was not until Man settled into towns that he started to manufacture jewelry and adornments in earnest. Over six thousand years ago, the great city-state of Ur on the Euphrates was importing gold and silver from the Anatolian highlands, and highly skilled craftsmen were working these precious metals into bracelets and pendants, plates and headbands, cups and rings,and helmets. Man since then has never ceased to surround himself with brightness, searching always for more satisfying metals to shine and glow, more brilliant jewels to sparkle in the light.

Symbols Of Status

Always, though, the underlying motives have been the same: sexual attraction on the one hand and the establishment of status and the right to hold territory and possessions on the other. Spears, swords, armor, and shields have always been brightly polished, designed as much to awe as to kill. The military mind has no doubt argued that this was primarily to make sure they were clean, a rationalization of sergeants down the centuries. But today, when camouflage and concealment are vital in the field, weapons and insignia are still burnished as brightly as ever. If necessary, they are then solemnly dulled again before battle. The higher the rank of an officer, the more gold braid and silver stars are likely to encrust his shoulders and lapels. Even nuclear ICBMs are no doubt lovingly polished by their subterranean military acolytes, and our choice of plated or stainless steel cutlery reflects the age-old belief that a knife should shine to be truly effective.

Nor is only military status enhanced by brightness. Mayors, master masons, and the chairmen of municipal grocers put on their silver chains of office; sportsmen receive shiny medals and cups; many a motorist spends as much time polishing the nickel-chrome plating of his auto-

Blue etched and gilt armor made for King Christian I of Saxony

The Lifeguards of Britain's Household Cavalry wear gleaming cuirasses and helmets with bright scarlet jackets and white buckskin breeches.

mobile as he ever does driving it around.

Religion, too, is usually intimately bound up with brilliance. Puritan simplicity is rare, historically; more often the drab lives of worshippers are brightened by magnificent regalia, vestments, and temples. Many people have deified the sun itself, the brightest object known to Man. The Aztecs of Mexico tore out the living hearts of prisoners to propitiate their sun-gods; modern sun-cultists travel hundreds of miles to lie torpid under the glare of their god, anointing themselves with holy oils in case he burns their skins in wrath.

Is The Magpie Becoming A Peacock?

In a technological age, Man has found new divinities. The snorting steam locomotives on our railways and the throbbing turbines of our great ships were always liberally adorned with polished nickel and brass fittings, to shine and glow in the light of the furnace. More prosaically, which of our transistor radios, dishwashers, motorboats, or TV sets does not glitter with metal—which on an objective basis is sometimes non-functional? When the Queen of England flies overseas, every square inch of the outside of her aircraft is carefully burnished by hand. What matter if cloud or rain or dust will dull that shine within minutes of takeoff? That is how Britons wish their Queen to travel—and no doubt Americans feel the same about the President's *Spirit of '76*.

The use of brightness to enhance sexual attractiveness in modern Western Man hardly needs describing—at least not for modern women. Brilliant fabrics, real and artificial skins and furs, lustrous paints and creams, shining metals, sparkling jewels and glass combine in varying degrees of explicitness and taste to enhance the sexuality of the possessor.

Masculine personal adornment, though, has been rigidly circumscribed for the last century or so in Western societies. Shiny metals have been limited to one or two simple rings, a wristwatch and goldcapped teeth, and vivid clothing largely restricted to the military. Fearful perhaps lest his eclipse in display should lead, like that of the phalarope, to a loss of his customary primacy in society, the modern male is returning to tradition. He is taking to cosmetics, although he pretends they are used purely for cleansing or to facilitate sun-worship; his briefcase and umbrella are becoming more shiny; his clothes are breaking out of decades of gray and brown worsted; his jewelry again includes shiny metal bracelets and precious stone pendants.

Man has never ceased to be a magpie. Is he becoming a peacock once again? Either way, he is never likely to conquer the fascination with brightness which is part of his inheritance.

Prince Philip's rank as an Admiral of the Fleet is denoted by gold braid and a golden lanyard.

Given the Glaxo Science Writer of the Year award by fellow journalists in 1970, Jon Tinker writes weekly on the environment for *New Scientist*. At 16 he presented a paper to the British Association for the Advancement of Science and at 17 took part in a three-month National Institute of Oceanography deep-sea research cruise in the Atlantic. After graduating from Cambridge University with a degree in zoology and philosophy, he worked for the UK Council for Nature and then edited *Wildlife* and the *Countryside*. Now aged 31 and the only British journalist writing full-time on environmental issues, he works as a freelance writer for *The Observer*, the *Daily Telegraph*, radio and television, and is completing a book on pollution.

PICTURE CREDITS

Pages 2, 3 (above) John Markham, London
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BRIGHTNESS...
The Symbol
of Value.

Man possesses
no treasure
which he values more
than Nature's bounty
of brightness...
and his own creations
attaining brightness.

Facets of Brightness

In *The Magpie In Man,* Jon Tinker has shown us that there is in animals, and, indeed, in the human species, too, some gene or instinct that is magnetically attracted to brightness. Brightness is in our bones. Our ancestors worshipped it, found hope and inspiration in it. They devoted lives to it, travelled to the ends of the earth for it, killed for it.

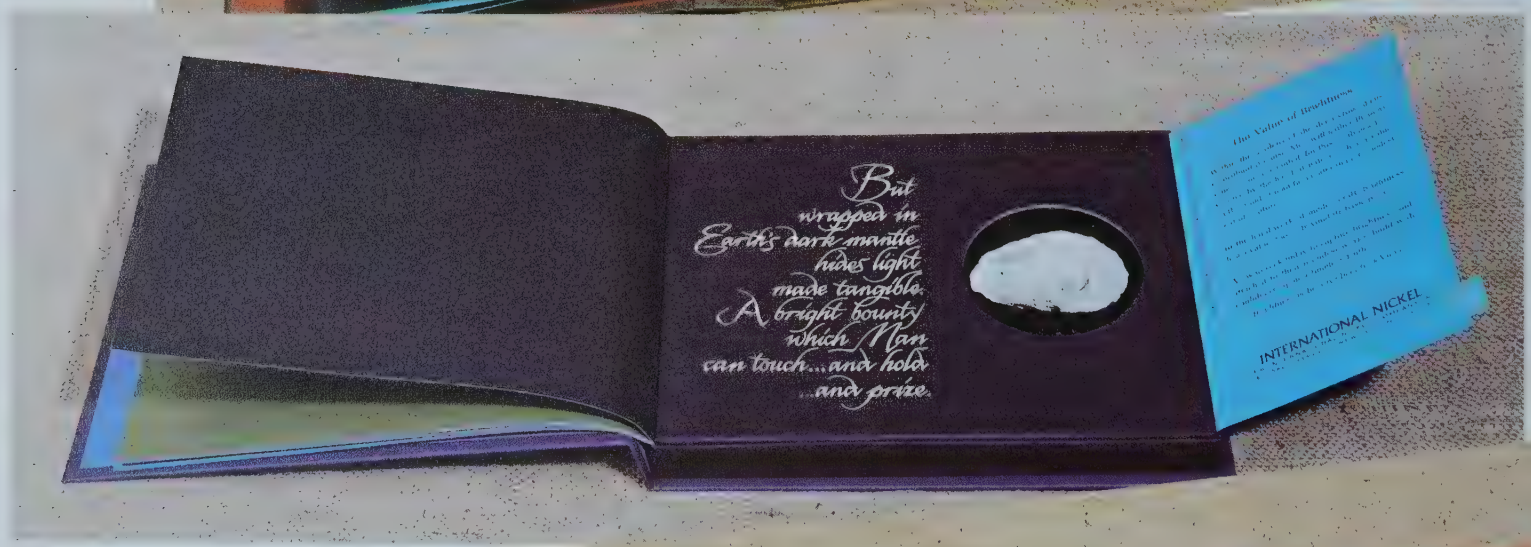
From the beginning of recorded history, we find evidence that man has sought to adorn his proudest creations and possessions with polished metal, stone, or glass. To this day, we use captured or manufactured brightness to confer rank, status, and worth.

The designer uses bright metal to highlight, to define, to enhance, to reflect, to decorate with symbols of beauty . . . to accent, to lead the eye with an arrow of light. The manufacturer uses it as an economical dressing—beauty that is readily at hand. In marketing his products, he uses brightwork to differentiate members of the same family and to identify models and series. And, confidently, he uses it to add sales appeal, reaffirming his faith in a timeless truth: *Brightness is Beauty . . . Beauty is Value.*

Several years ago, with the aim of reminding automobile manufacturers—and especially their designers—of the inherent appeals of bright metal, International Nickel began a program called *Facets of Brightness.* A series of unique exhibits and mailing pieces traced through recorded history man's fascination with bright metal and his use of it as a measure of value and a tool to achieve many purposes. Here are a few examples.

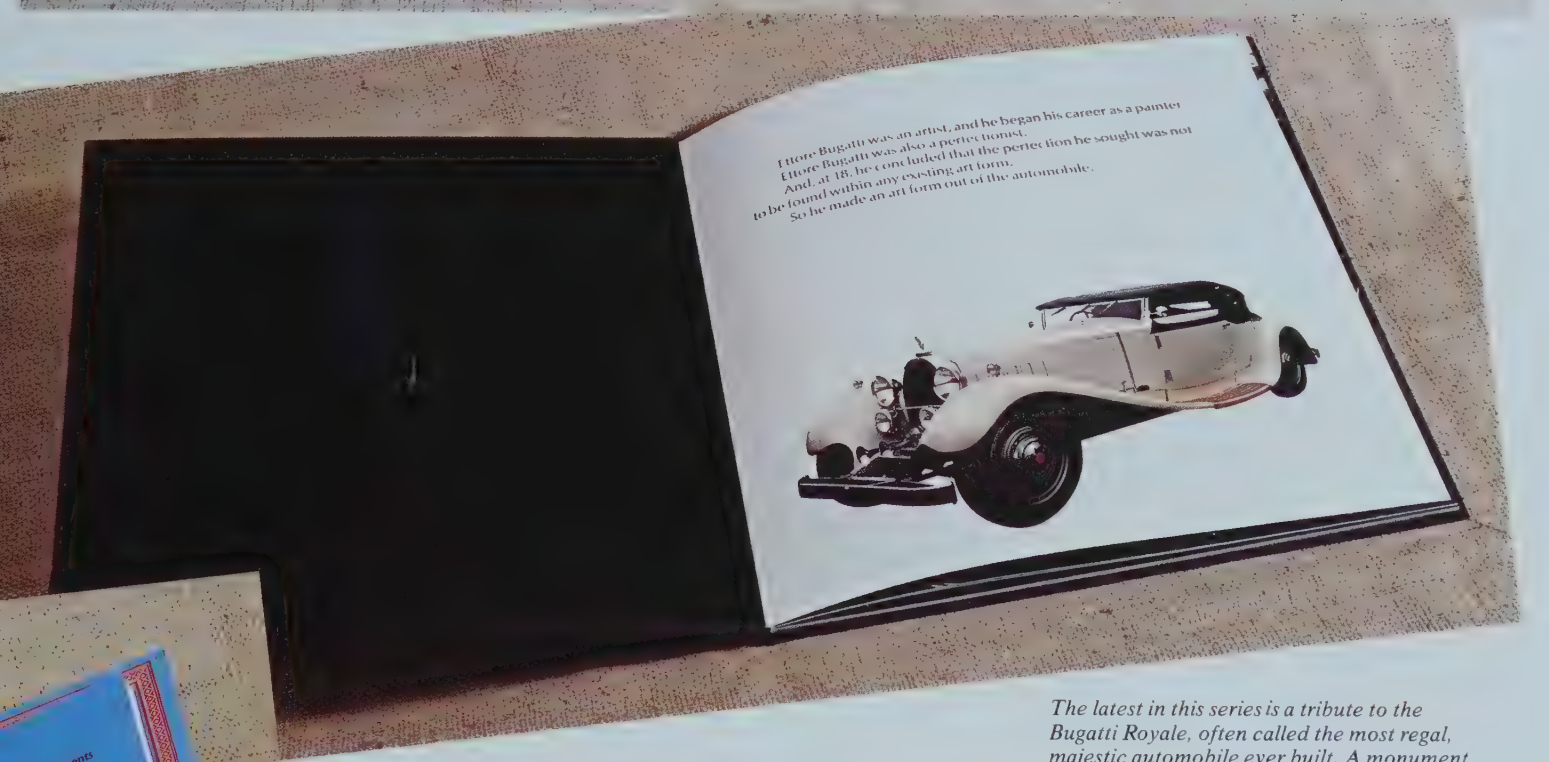
From a nickel-chromium plated coffeepot to a Jose de Rivera sculpture, visitors to Inco's booths at several shows were able to see many Facets of Brightness *at first hand.*

This portfolio told—in the archaeologist's own words—of one of the great discoveries of the 20th Century: the tomb of the Pharaoh Tut-ankh-amen. And one of the great mysteries of all time: Why had the thieves who had entered the tomb many centuries before left behind a fortune in jewels and other treasures and taken only the one object that most fascinated them—a bright, reflective mirror?

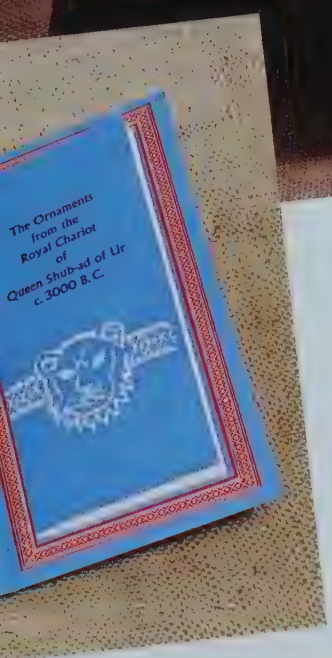


This first mailing piece in the Facets of Brightness *series demonstrated with photographs and an actual cultured pearl how nature creates beauty with brightness.*

This folio told how Lord Geoffrey of Anjou, in the 12th Century, resolved to identify himself in a manner both bold and distinctive. "Upon his great five-foot shield he emblazoned a rampant lion wrought of bright metal."



The latest in this series is a tribute to the Bugatti Royale, often called the most regal, majestic automobile ever built. A monument of the past, an inspiration to the future, the Royale was ahead of its time in the use of nickel stainless steel and nickel-chrome brightwork.



Six thousand years ago, the Sumerians invented the wheel. From one of the first vehicles to move upon the earth—the sledge-chariot of the Sumerian Queen—this folio presents history's first vehicular bumper, gleaming with a proud lion of brightwork.

Photographs by E.S.Y. Lau, Inco Inc.


EUROLINER

The Great Containership Race

by MALCOLM HODD

Developments in the international movement of maritime dry cargo have been dominated in the last half-decade by a single theme: containerization. Shipping lines have poured millions of dollars into containerships, containers, and associated back-up systems. Yet profits in this new and intensely competitive branch of shipping have been elusive—leading to doubts over the viability of this newest freight transportation science.

Since the mid-sixties, operators in the world's liner cargo trades have switched hopefully to containerization in an effort to contain steeply rising costs. An estimated 34 deep-sea container services are now in operation, with another 17 proposed. Operators now have over 130 full containerships in service or on order, with the capability to transport more than 177,000 freight containers. In 1970 alone, capacity of the world container fleet increased by 60 per cent, while the number of freight containers in service has already reached some 400,000.

It has been calculated that by 1975 over 200 containerships will be in operation, able to carry over 60 million tons of cargo annually, and that eventually the freight container may account for 75 per cent of world liner cargo movements. These figures are important, indicating the rapidity with which containerization has penetrated major liner routes since its international debut five years ago.

Inaugurating Transatlantic Service

Until 1966 containerization had been confined to U.S. domestic routes, including those to Puerto Rico and Hawaii. The leading operator was Sea-Land Service, a shipping company that grew from a trucking empire to be the world's leading container operator. Today Sea-Land's container fleet numbers over 40 vessels, with over 45,000 units. Sea-Land's philosophy has become a widely followed doctrine for emerging container operations. Their trucking experience proved that operations ashore were a crucial factor in the intermodal chain; ships were regarded as merely one more category of hardware in door-to-door movement of freight.

When Sea-Land's containerships inaugurated the first regular transatlantic container service, late in 1966, Europe's traditional shipping lines had to admit that only a complete change of role and philosophy would enable them to compete effectively with low-cost container operations. In fact, they had been seeking more efficient operation of cargo liner tonnage for some years. But even sophisticated cargo liners could not overcome the basic inefficiencies of a traditional port infrastructure. While costs soared, productivity with traditional tonnage was hampered by wasted hours and even weeks taken to turn the ships around in port. Containerships could be turned around in two days or less, offering a greatly increased utilization of capital employed. What followed was, in fact, a frenzy of investment in containerization hardware.

Getting On The Bandwagon

Much of the initial attention in 1966-67 was focused on the North Atlantic, where as much as 80 per cent of the five-million-ton annual flow was regarded as susceptible to containerization. One by one, U.S. flag operators on the route followed Sea-Land, seeing in the "container revolution" a golden opportunity at last to place their costly labor-intensive ships on a competitive footing with the Europeans.

Traditional European operators responded, though more slowly, as the investments necessary to build a fully container-oriented operation were in most cases too great for individual com-

Ships and containers: Seatrain Lines' new gas turbine powered containership Euroliner. *First in the world, she captured the North Atlantic freight speed record on her maiden voyage earlier this year.*

(1, 2, 5, 9) Portainer cranes loading and unloading containers at the Southampton, England, Container Terminal. (3, 8) The Dart America *in port. (4) The European Container Terminal N.V. at Rotterdam's Europort is the largest container terminal in Europe. (6) Easy-to-clean nickel stainless steel is used to clad the carbon dioxide storage tanks on board the Bay Class containerships operated by Overseas Containers Limited (OCL). (7) Fabricating a nickel stainless steel bulk liquid container of unusual design at Westerwälder Eisenwerk in West Germany.*









panies to "go it alone". Their response took the form of the now familiar consortia pattern, resulting in multi-national groupings like Dart Containerline and Atlantic Containerline. In Germany two leading shipowners, Hamburg-Amerika-Linie and Norddeutscher Lloyd, formalized a long-standing though unofficial link to bring about the Hapag-Lloyd Container Line.

In Britain four big shipping groups contributed to the formation of Overseas Containers Limited, five to the creation of Associated Container Transportation. Between them OCL and ACT formalized plans valued at around £300 million, with a substantial slice of this budget allocated to containerizing the trade with Britain's traditional partners—Australia, New Zealand, and South Africa. Meanwhile, containerization was expanding rapidly on another early proving ground—the Pacific, where American and Japanese operators were building up their containership fleets. Growth in 1968-69 was even more rapid than in the North Atlantic. But, just as the decade was set to close on an expansionist note, problems began to emerge.

Hopes Vs. Performance

Containerization was not achieving all that had been promised. Instances of containers being lost overboard from ill-equipped vessels, not originally designed with containers in mind, and instances of goods being damaged due to improper stowage, left the insurance market wary of containers. On the waterfront, labor fought containerization tooth and nail, and is still obstructing container developments in many areas. Both directly and indirectly, operators found themselves paying a high price for labor's necessary concessions to the container era.

Toward the end of 1970, when financial setbacks for a number of big container operators were widely publicized, the inevitable backlash set in. Financial losses for some operators—far greater than expected, even with amortization costs considered—and below-par performances by elements in the hardware chain on certain routes did not pass unnoticed by transport commentators. In short, the containerization concept had sustained a number of blows to its image as the dynamic, efficient system of freight transportation in the 70s.

Ironically, it was inflation—the very economic factor that the container promised to combat successfully—that was noticeably upsetting the plans and promises of the operators. Dramatic increases in the cost of shipbuilding, oil fuel, and seagoing labor combined to force operators to adjust the profitability timetable on their mammoth container investments. Assertions that shipowners were bulldozing shippers into "thinking container" were heard from the embryo anti-container lobby. And in certain trades the use of more flexible roll-on, roll-off vehicle ships, albeit with container capability, was interpreted in some quarters as a broad hint that the containership was not as efficient as had at one time been thought.

Then the first of a completely new breed of freighters—barge carriers—entered service. Carrying high-capacity freight barges aboard a "mother" ship, these vessels do not require the extensive and costly shoreside facilities implicit in the container trades. All that is needed is a deep-water anchorage for the mother ship so that the barges can be towed inshore or upriver and serviced by the most basic cranage and port facilities.

To date, 18 of these ships have been ordered by five major carriers—all of whom have containership interests as well—for serving the special needs of trade with the Gulf of Mexico, the Far East, and the Mediterranean area. Several are in service already, though their long-term viability has yet to be proved. While impressive plans approached fruition and container carriage on existing ocean routes boomed, the first rush of orders for container hardware slowed,

The Dart Europe *at the Southampton Container Terminal, England.*

A giant crane lowers a container into place.

and the newly formed and prosperous container industry began to consolidate to await the growth of the important replacement market.

Cutthroat Competition

Far more important in the course of the past year has been the culmination of competition and profit problems for the big operators. These have presented a public challenge to the capital-intensive container concept. As the first to have been intensively containerized, and where competition for cargo has been exceptionally fierce, the North Atlantic routes have been the scene of most of the action here.

Among them, the four U.S. flag and three European operators dominating the route have 35 ships, lifting about 60 per cent of the annual flow of five million tons of liner cargo. Several more ships are planned and the expectation is that container vessels will eventually take over as much as 80 per cent of the North Atlantic traffic.

But though operators have by no means exhausted the total market, they have built more than enough containerships to cope with present demand. This overtonnage situation has led to cutthroat competition and rate-slashing, to which all the carriers eventually had to resort to protect investment and maintain an albeit reduced revenue flow.

The skirmishing that began almost two years ago had escalated to a battle by the middle of this year and has become a dominant issue on the container scene. Its consequences have been of uniform effect, differing only in terms of degree. All the operators have suffered financial losses through maintaining their involvement. But U.S. flag operators, lacking the broader-based corporate structure of their European rivals, have fared the worst, and have not proved as effective at catching cargo as the Europeans.

The drop in revenue (rates have been slashed by as much as 30 per cent in some cases) has forced one U.S. operator out of the trade and caused the pioneer Pacific container operator Matson to shelve plans for a North Atlantic service. Another American operator is currently expected to cut back their hardware commitment, owing to heavy financial losses resulting from the fray. Meanwhile, America's top "traditional" container operator, U.S. Lines, may be taken over in due course by Sea-Land as a result of its losses.

Is Peace In Sight?

The crucial factor demonstrated by the inter-line struggle has been the basic change of role that containerization has forced on the shipping lines, and it is this difficulty to adjust, rather than faults in the container system itself, that has led to the current situation. Those companies that have successfully adapted their managerial and marketing attitudes to the new era of involvement on land have generally fared better in the recent struggle. And now that the end of the battle on the North Atlantic is in sight, marketing know-how and service to the customer are likely to replace rates as the key competitive weapon.

The solution to the rates-tonnage problem is being engineered in the form of a revenue pooling agreement among the "big seven" lines. Under this agreement, lines will be limited to certain specific shares of the available cargo, which, under the terms of the agreement, must not be individually exceeded.

Stability in the North Atlantic, which could be cemented before the end of this year, if U.S. inland pressure groups do not hamper agreement on the pool arrangement, will form a precedent for peace in the Pacific, where competition between American and Japanese containership operators is openly building up for a similar conflict.

Containerization "Down Under"

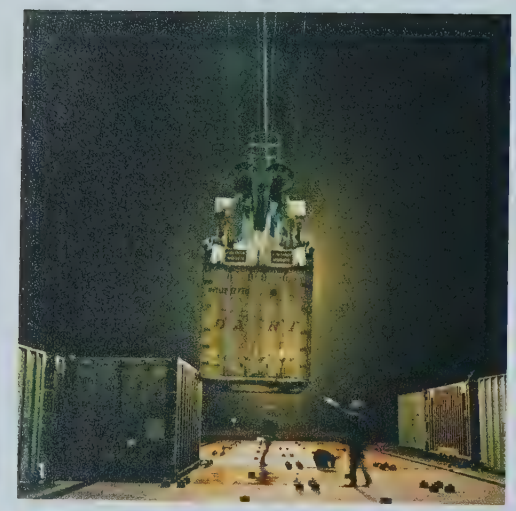
Though the North Atlantic conflict has stolen much of the container limelight during the past year, events in the Aus-

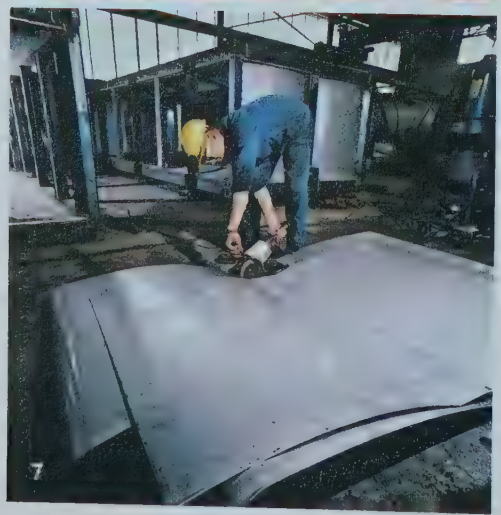
It's a rough, tough life for containers—and tough, too, on the containerships that have to spend as short a time as possible in port—in this capital-intensive industry. Containers have to stand up to rough handling, accidental damage, rain- and sea-water corrosion, pilferage. More and more, operators are turning to nickel stainless steel, with its high strength-weight ratio, both for dry cargo and, more particularly, for bulk liquid transportation. Here its hygiene, corrosion resistance, and ease of cleaning are speeding turnaround even of widely varying loads.

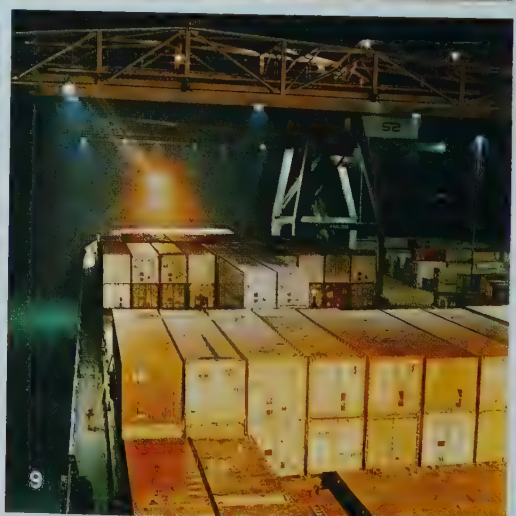
Containerships spend at least 50 per cent more time at sea than conventional cargo ships—in fact, their profitability hinges largely on complete reliability at sea, a quick turnaround in port, and the need for the barest minimum of maintenance. So nickel-containing materials are being increasingly used in all kinds of applications where their proven dependability, their special heat- or corrosion-resistant properties, and their ease of cleaning are helping to keep operating costs down.

Fabricating a nickel stainless steel bulk liquid container at the works of W. P. Butterfield in England

(1, 2, 5, 9) Work at the Southampton Container Terminal goes on 24 hours a day – loading, unloading, storing, stacking, (3, 7) Fabricating a nickel stainless steel bulk liquid container of unusual design at Westerwälder Eisenwerk in West Germany. (4) "Stuffing" a container with Inco products at the Clydach nickel refinery in Wales. (6) The cladding, corner posts, door facing, and part of the framework of this dry cargo container, built by Fruehauf Trailers of Australia, are of nickel stainless steel. (8) A container goes into place aboard the Dart America.







tralian trade have also caused unfavorable comment on the real virtues of containerization, much of it from the Australians themselves. This has developed despite some remarkably successful "firsts" by Australian shippers in dramatically cutting damage rates on high-value items, and greatly improving the quality of exported foodstuffs.

First containerized in 1968 by the U.K. OCL/ACT groups, the Australian trade was initially serviced by the eight containerships operated by their partners. More recently French, Dutch, and German companies have added their ships to the trade, forming the Australia Europe Container Service as a joint venture with extensive cooperation among the lines involved. But OCL has run into financial problems. Instead of seeing the first profits from their major investments next year, their service is not now expected to be out of the red before 1974. By the third quarter of this year OCL's accumulated losses alone were expected to reach £14 million.

Some Australian shippers courted by the lines have also been unhappy. Labor problems at Australian ports and delivery and voyage delays built up by poor performance at newly designed terminals have contributed to Australia's present disenchantment with containers—as has a bloody financial nose for Australia's national shipping company, Australian National Line, after its entry into container operations with British and Japanese partners. Waiting in the wings, a big Scandinavian shipping group is quietly courting shippers with a flexible and fast roll-on, roll-off service scheduled to commence next year.

Signs Of A Healthier Future

Proposals for the further conversion of key routes to container-oriented operations (notably the more than £300 million investment in services between Europe and the Far East) and the encouraging signs that front runners on present major routes are thinking of profitable cooperation rather than competition, are indications of a healthier future for the presently uneasy containerization industry. International cooperation is undoubtedly the key to profitable success for container operators and users alike, and it is encouraging to see that this lesson is finally being learned.

With plenty of financial ammunition available to them at present, the cynicism of the container critics is at least understandable. But the anti-container lobby, presently riding high, tends to miss a number of key points. Once over its initial teething troubles (often the fault of operators and not a reflection of flaws in the system), containerization has unquestionably streamlined and speeded up the international movement of goods between producer and consumer. Customers can now take seriously promises of shorter delivery dates of large shipments—something they could never do before.

And although its comparative inflexibility is often cited, the container has proved far more flexible in operation than even the experts originally expected. The clear need to adopt standard sizes for freight containers has not proved to be the deterrent that would rule out container shipment of many special categories of freight.

Both direct and indirect savings through the increased efficiency of the container system have been supplemented by major reductions (now that the users are experienced) in damage to cargo, while pilferage has also been extensively cut down. Sensational losses of containerized cargo do still occur, though these are the exception rather than the rule; a decade ago, when the vast mass of general cargo moved as "break bulk", the reverse was true.

In deference to the changing economic realities in an inflationary climate, the container operators have not been slow to adapt their claims for the merits of the system. Shipping companies no longer assert that the container will bring across-the-board reductions in the cost of moving sea freight. Today the claim is that the efficiency of containerization, and the unit-load variants whose growth it indirectly stimulated, can and will hold down the rate of cost increases. To this degree, the original advantages of the system have been upheld by events.

With the revolution over, the new regime is settling down to tackle the problem posed by the advance of technology over transportation "software"—and in this area there is undeniably a long way to go. But in spite of such problems, those who successfully made the transition from traditional shipping line to intermodal operator have fulfilled the hope that the freight container would in the long run cushion the effects of the dramatic rise in the cost of international freighting.

With containerization available to them, few export managers would seriously wish to see the clock turned back to the bad old days of break bulk. In spite of its traumatic adolescence, containerization is a proven system; unquestionably it is here to stay.

Malcolm Hodd, editor of *Containerisation International*, has been with the London-based magazine since its inception in April 1967. He has thus been in an unrivalled position to watch the development of containerization from the early euphoric "container revolution" days when containers first came to Europe, to the current climate of realistic appraisal. He has been closely involved with transport and physical distribution journalism for the past twelve years.

PICTURE CREDITS

Page 12: CASPR, Manchester, England.
Pages 14 (1, 2, 3, 5, 6, 7, 8, 9), 15, 16, 17, 18 (1, 2, 3, 4, 5, 7, 8, 9): R. Maynard-Smith, Inco Limited
Page 14 (4): Schaart en Buyse, Rotterdam
Page 18 (6): Associated Steamship Pty., Ltd., Australia

PRODUCTION MEANS PEOPLE

Capital, technology, markets—they are all important. The vital element to any successful industrial enterprise, however, remains—PEOPLE. On these pages are a few of the thousands of people who are responsible for the day-to-day operations of the worldwide International Nickel organization.

In the "dry" of Inco's T-3 mine in Thompson, Manitoba, the camera of Arthur d'Arazian caught this group of miners. Each is an individual—different from his fellows in height, weight, taste in clothing, family background—just about every facet of his existence. Even their likeness as a group of miners sets these men apart from hundreds of other Inco employees—scientists, explorers, technicians. Yet they all have one thing in common.

Although generally depressed business conditions have recently caused a lessening demand for nickel—leading to a current surplus of nickel supply over demand—Inco continues in its expansion and modernization program in Canada, confident in an average growth in nickel consumption of about 7 per cent per year. In addition to new mine development, the program includes the Clarabelle mill, with new ore-crushing and concentrating machinery; the Copper Cliff nickel refinery, a highly automated facility with an annual capacity of 100 million pounds of nickel pellets and 25 million pounds of nickel powder; and the Frood-Stobie Mill, with a capacity of 25,000 tons of ore a day. It is people like these miners on whom Inco must count to make the program a success.

PICTURE CREDITS

Pages 20, 21 (bottom): Arthur d'Arazian
Page 21 (top): John H. Cornell


FOY
WISNER
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FALCONBRIDGE
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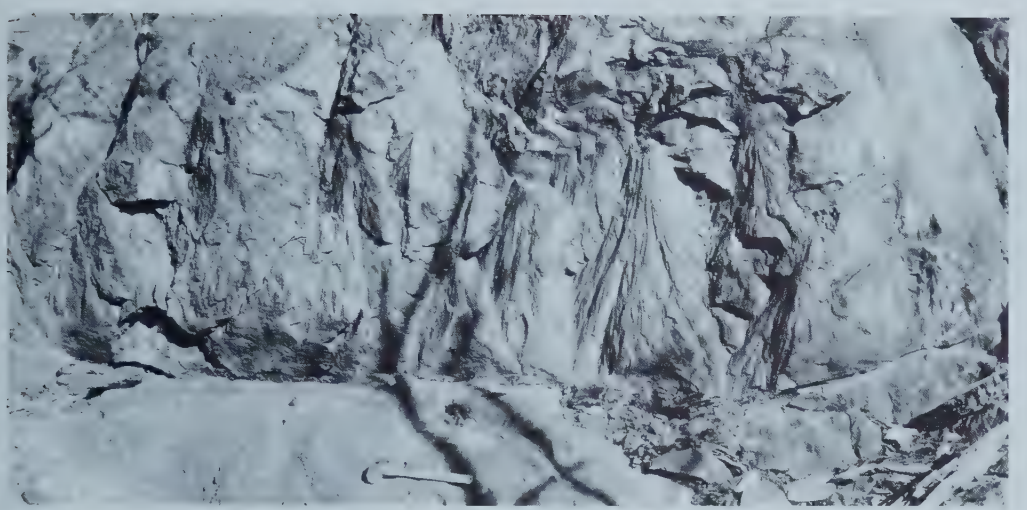
NEELON
GRAHAM
BRODER
WATERS
DENISON

THE BIG BANG AT SUDBURY

by JON RUDDY



A moving pinprick of light in the night sky became a falling star, then a blinding white sun. Soon it seemed to fill the whole vast firmament as it punched through the earth's atmosphere at 50,000 miles an hour, a fiery thing descending on a shallow sea. From far in its wake came a jet-like screaming. Then it exploded—in a flash beyond seeing and a roar beyond hearing.

Under the blast the sea boiled and its bed melted. The water parted and tidal waves began to roll around the world. There was a hole in the sea and at the bottom a white pool of molten lava. A huge pale mushroom grew in the sky. Now the sea rushed back, found a crater and boiled again.

The world rang like a bell and the sky rained rock. Clouds of vapor swirled above the turbulence. The blast made its own weather so that jagged shafts of lightning illuminated the apocalypse. The walls of the crater collapsed and slid into its centre; now it was more than 50 miles across. And from the mantle of the earth molten rock and concentrations of iron, nickel and copper sulphide began to move up along deep fractures to occupy a funnel of broken rock below the crater. One day it would be called the Sudbury Basin.

Evidence for the similarity of origin of Ontario's Sudbury Basin (left, above) *and the moon's Copernicus Crater* (left, below) *are hundreds of rock fractures, or shattercones, like those shown above. Sudbury has more shatter coned rock than any other place in the world.*

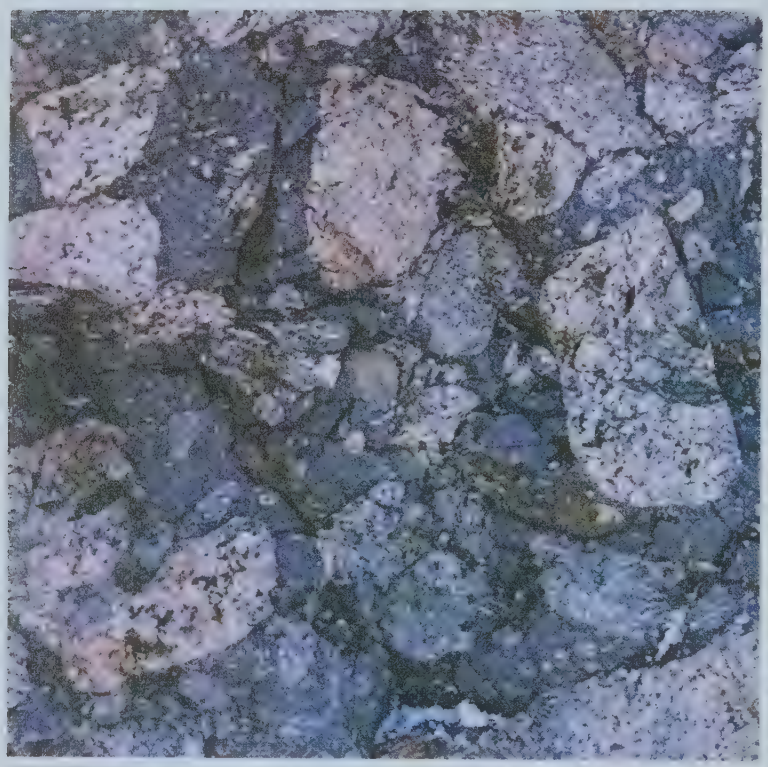
All this happened—if it happened—two billion years ago. There were no witnesses, the only victims of the catastrophe being some unfeeling algae that represented the first flickering of life on the planet. Those closest to the site today—geologists of The International Nickel Company of Canada, Limited—admit that this story sounds pretty wild and that there are doubters within the scientific community and at Inco itself. Still, there is persuasive new evidence, and most who study it no longer doubt that the Sudbury area, in the Canadian province of Ontario, is the site of the greatest found *astrobleme* (from the Greek: "star wound") in the world, and that Inco is figuratively—though not physically—mining the heavens.

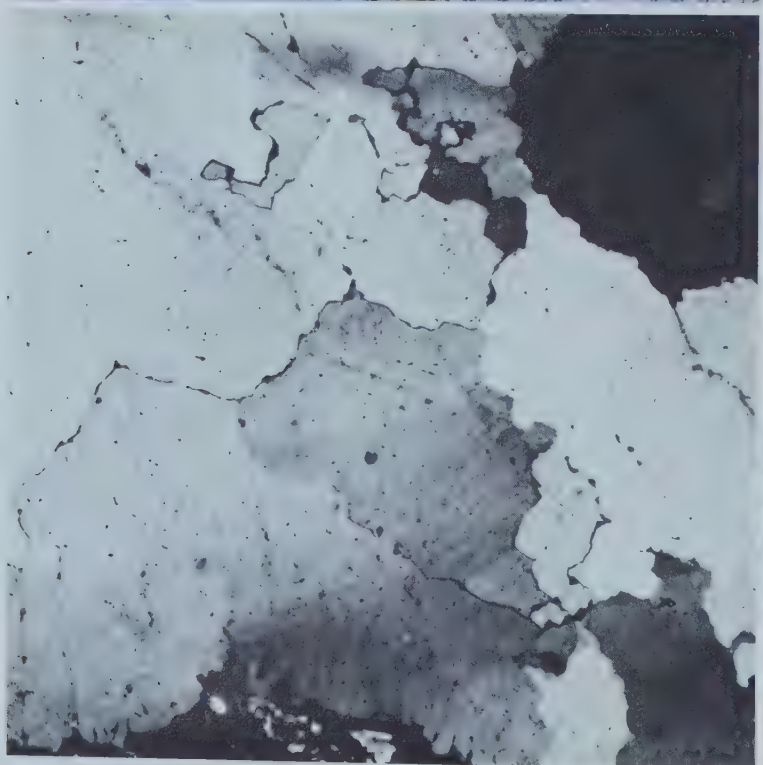
How Big Was It?

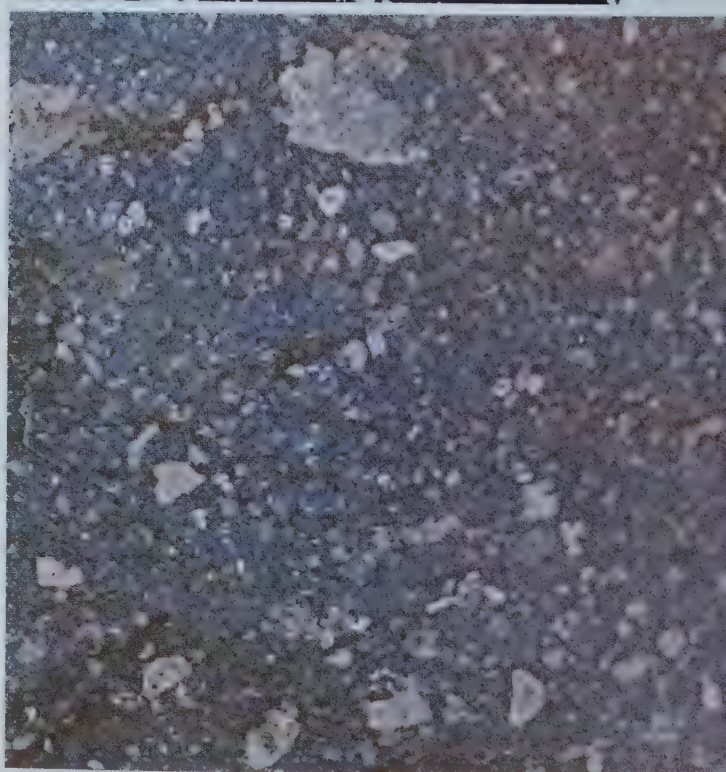
Millions of meteors hit the earth's atmosphere every day and are consumed in fire. We call these bits of heavenly refuse "falling stars" or "shooting stars," although most of them are no bigger than the nail on your little finger, their visibility being a product of heat rather than volume. Somewhat larger meteors often reach the earth, at which point they become known as meteorites. Once in a long while—no living man has seen it happen—the explosive impact of a much bigger object forms a crater. There are many recognized impact sites around the world; the most famous may still be the Barringer Crater in Arizona, three-quarters of a mile in diameter, with walls of 600 feet. If the Sudbury Basin is indeed the remains of a meteorite crater, it is certainly much older and more portentous and perhaps one million times as big.

How big was the thing that dug it? Dr. Guy Bray, now Inco's manager of geological research and the man assigned to assess what had been regarded as no more than an intriguing speculation, believes that the meteorite may have been an asteroid three or four miles in diameter. "There are a lot of

There are many kinds of evidence for the "big bang" theory, including (upper left) *breccia, rock composed of fragments broken by an explosion; quartz with planar features created by shock waves* (upper right) *that present a quite different microscopic appearance from ordinary quartz* (lower left); *and the explosion debris in the Onaping formation* (lower right).







chunks floating around the solar system that are much bigger than that," he says. "Some of them must occasionally collide with the earth." Falling at between 6 and 12 miles per second, the fiery sphere lost little of its mass in the atmosphere and exploded like an atomic bomb when its kinetic energy was suddenly transformed into thermal energy. Here Dr. Bray, who is tall, bearded, and soft-spoken, makes a complex fluttering gesture. "There was an almighty bang," he says. "The Russians' claimed 100-megaton bomb is the equivalent of 100 million tons of TNT. But we're talking about *millions* of megatons."

An Inspired Amateur

The theory of the almighty bang has been confirmed to Dr. Bray's satisfaction during the past several years. "I'm a believer," he says simply. The story of its proposal and slow acceptance has a beautiful terminology of its own—shatter cones, mud balls—and it points up, among other things, the fact that the thinking of inspired amateurs still performs an important function in the specialized sciences.

The inspired amateur is, in this case, an amateur only in the sense that his interest in meteorites is an avocation rather than a specialty. Dr. Robert S. Dietz is a U.S. government oceanographer, a marine geologist primarily concerned with the ocean floor. In the mid 1940s he became interested in the "seas" on the moon and concluded, correctly, that they were related to impact sites. He began looking for very large craters on the earth and coined the name "astrobleme" to describe them.

Meanwhile scientific interest in meteorites had intensified, partly because of the Apollo spacecraft missions. In Canada, Ottawa's Dominion Observatory acquired an international reputation in this new branch of science, leading the world in field study of circular structures. To date nearly a score of meteorite craters have been recognized in Canada. But it was Dr. Dietz who, having never been there, concluded in 1961 that the Sudbury Basin, a pleasant farm belt surrounded by the rocky hills of the nickel irruptive, could well be a meteorite crater. This despite the facts that the Basin was not circular in outline but kidney-shaped, 17 miles wide by 37 miles long, and that few geologists in what is probably the greatest nickel mining area in the world had ever seriously considered the idea.

A Brilliant Feat

Dr. Dietz's intuitive leap was based on the already established evidence that the Sudbury Basin was deformed by more recent natural stress from the southeast and on the widespread presence around the site of *breccia,* rocks composed of broken fragments and associated with a convulsion of the earth's crust. What would prove the theory to his own satisfaction was the presence of shatter cones, rare, conical rock fractures which, he believed, could be formed only by meteorite impact.

The shatter cones, marked by fine striations (or lines) and horse-tail patterns, appear in large numbers on hard rock faces at impact sites, and their axes tend to point in the direction of the explosion that formed them. At this time fewer than 10 natural occurrences of shatter cones were known in the world.

"It was quite a brilliant intellectual feat," says Dr. Bray. "Dietz really stuck his neck out. He believed there would be shatter cones, then he came up to look for them and, by Jove, he found them." In 1964 Dr. Dietz published his findings in *The Journal of Geology.* He also suggested that the precious ores came from the meteorite itself—an idea still firmly rejected by Inco geologists.

Dr. Bray, who joined the firm that same year after two years of diamond hunting on Africa's Ivory Coast, found that his first assignment was to go out—"on the heels of Dietz," he says—looking for shatter cones. If they turned

Dr. Robert S. Dietz: His was "a brilliant intellectual feat."

To an untrained eye, the Sudbury Basin's gently rolling hills, tree-covered slopes, and peaceful farms don't look like a meteorite crater.

up in rocks younger than the impact itself, Dr. Dietz's theory would be disproved. "He was the first guy to find them," says Dr. Bray. "We set out to test the theory by seeing if they were all over the place. But Dietz was right all down the line. The shatter cones were where he said they should be and they weren't where they shouldn't be."

Shock Metamorphism

Sudbury, it soon turned out, had more shatter-coned rock than any other place in the world. And the apexes of the cones pointed generally inward, like arrows, to a point above the middle of the Basin. That part of the Basin geological structure called the Onaping formation is a dense, massive, dark gray to black rock containing smeared, plastic fragments suggestive of melting. Until recently it was presumed to have been volcanic in origin and was known by the swinging name of the Onaping tuff. This rock provided the evidence that convinced Dr. Bray, early in 1967, that the Basin was indeed the world's biggest astrobleme.

The agent in this case was Dr. Bevan French, a National Aeronautics and Space Administration (NASA) geologist specializing in the field of meteorite impact. The evidence he found was shock metamorphism, essentially comprising peculiar parallel cracks (called planar features) in fragments of quartz from the Onaping. These tiny cracks are found in nature only at meteorite craters where the hammer-blow of impact has left microscopic traces of extraordinary shock waves. French's findings indicated that the vast 4,000-foot-thick Onaping formation was not volcanic, but a layer of explosion debris.

Is It Heavenly Nickel?

Although Dr. Bray is satisfied that meteoritic impact occurred at Sudbury, he is sure that Dr. Dietz erred in concluding that Inco is physically mining the meteorite. Dr. Dietz himself still claims that it's a "distinct possibility." He says: "Ten years ago they laughed at my impact theory." Dr. Bray and his associates believe that the ore came from the depths of the earth, but now agree that "some of the irruptive might be impact melt."

To a layman, the idea that the ore came from the meteorite itself seems reasonable, since the ore bodies occur in patches around the irruptive as if blasted into cracks in the crater wall. But Dr. Bray says: "We reject Dietz's theory because many aspects of Sudbury geology are similar to nickel deposits around the world. For example, the ores are rich in copper, whereas meteorites are not. We see the nickel ores as an integral part of a huge irruptive mass from within the earth. We can't see the ore coming from heaven so nicely mixed up. But the meteorite impact would make a helluva fine trigger."

The exploding meteorite, in excavating a huge hole and smashing and melting the underlying rock of the earth's crust, encouraged the nickel irruptive and its ores to invade the crust from a natural smelter below. Over millions of years several miles of rock were eroded from the surface, exposing the ore. Such is the current working hypothesis among most Inco geologists. But what happened to the meteorite that started it all?

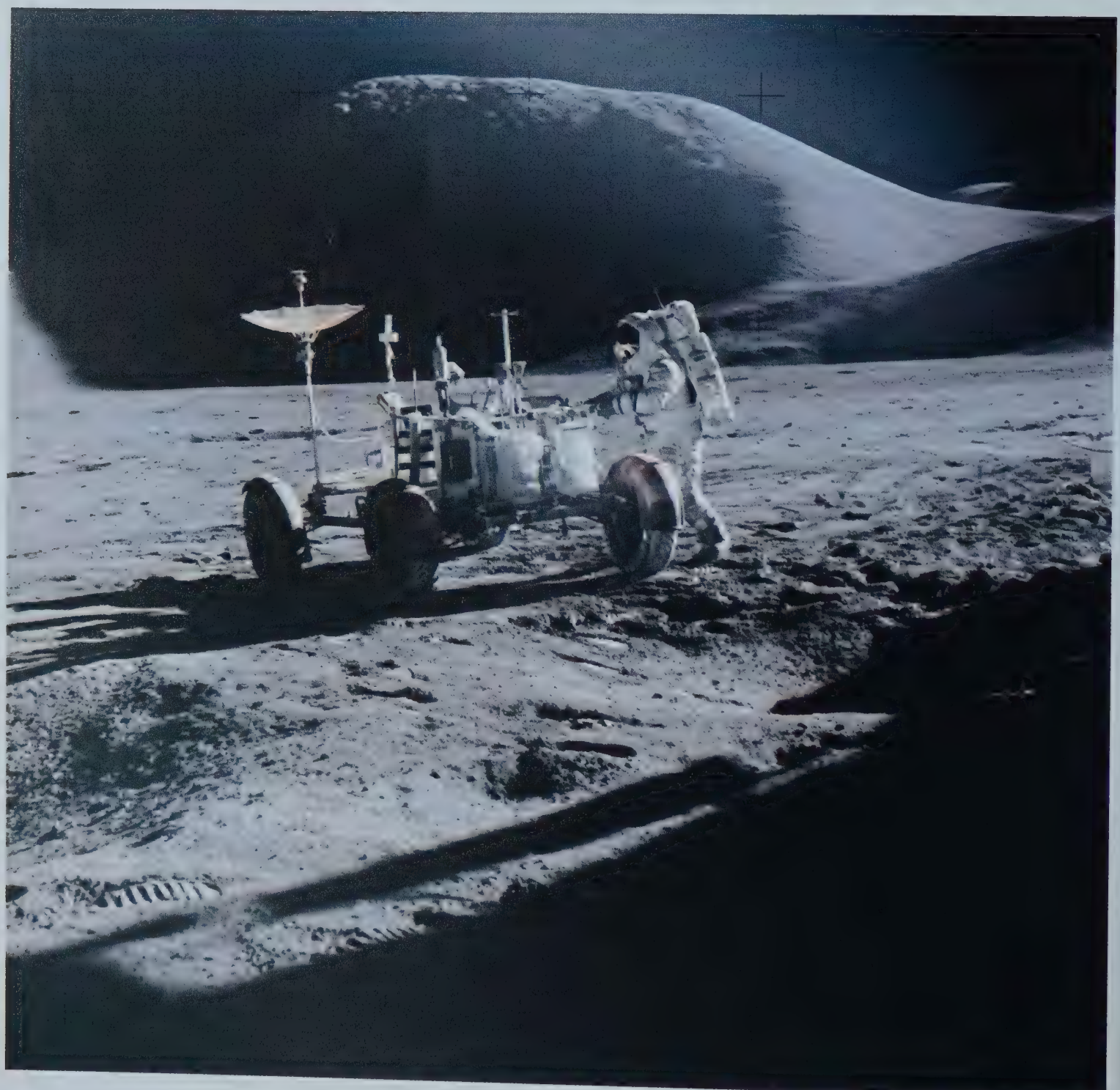
"It destroyed itself," says Dr. Bray. "Most of it was vaporized, melted, or fragmented. Erosion of the original Precambrian surface occurred, and traces of it simply vanished. Of course, it might not have been a meteorite at all. It might have been a comet head, which is composed of a sort of dirty ice. It might have been anti-matter. We'll never know."

A staff writer-editor at *Maclean's*, one of Canada's oldest and most respected magazines, for five years, Jon Ruddy began his career as a reporter for the Toronto *Telegram*. He inherited an early interest in minerals and geology from his father, who was involved in prospecting and mining. For the past four years he has written a regular column for the six Canadian editions of *TV Guide*. He has contributed to numerous magazines, books, and newspapers, and has written for and appeared on television.

APOLLO 15

Nickel and nickel alloys continue to play an important part in the Apollo space program. When, last July, man set foot on the moon for the fourth time in two years, the astronauts established another major record. They drove a "moon car", officially known as the lunar roving vehicle, or LRV. This vehicle greatly expanded the range of exploration and the expedition's ability to bring back a greater variety of materials than from other moon landings. The LRV's successful operation owed much to the versatility and reliability of nickel.

Nickel-base alloys helped to unfold the moon car from the package in which it was stored in the lunar excursion module (LEM). Inco-developed maraging steel, containing 18 per cent nickel, was chosen for the torsion bars that helped in deploying the aft chassis, and another nickel-containing alloy was specified for two springs used in deploying the forward chassis. Upper and lower torsion bars of maraging steel provided independent suspension for each of the LRV's four wheels. In more than 40 other key areas—from the engines to the ground support equipment—nickel played a vital role in Apollo 15.



NASA

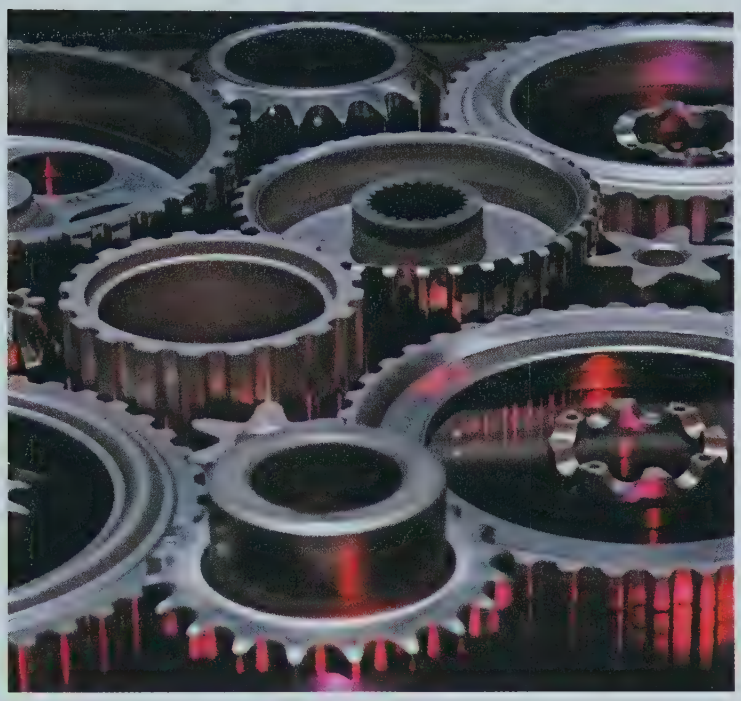
ASTRONAUTS WALK AT SUDBURY

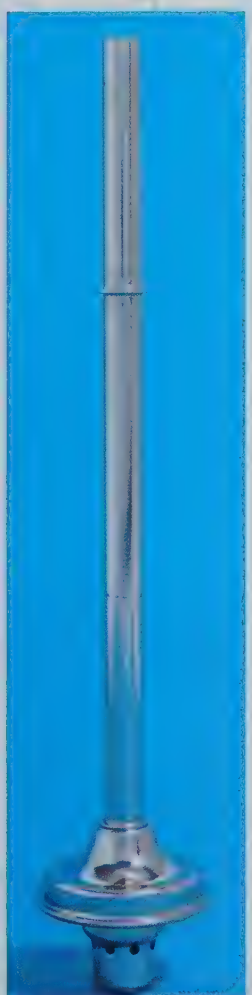
When that prehistoric meteor blasted into the Sudbury area, it did more than change the landscape. Exactly what it brought from outer space may still cause debate among geologists. But there is no question that—whether it brought things with it or created them on impact—the meteor provided for the Sudbury Basin a terrain that was markedly different from other parts of Ontario, or, indeed, of the North American continent.

Eons of weathering and geologic change have masked much of this uniqueness. Enough rocks and rock formations remain, however, to make the Sudbury area of prime interest to Apollo astronauts. From observations of the characteristics of rocks like these they will be able to tell whether a moon crater was caused by meteoritic impact or was volcanic in origin.

Two of Apollo 16's astronauts, John Young and Charles Duke, visited the area in July as part of their training for a scheduled March 1972 trip to the moon. Guided by Inco geologists, they learned to spot and identify rocks that they will be finding and recovering on the moon. Although regular space suits are too cumbersome for use on earth, the astronauts did maintain radio contact with "mission control" set up nearby.

ON THE FRONTIERS OF ENGINEERING

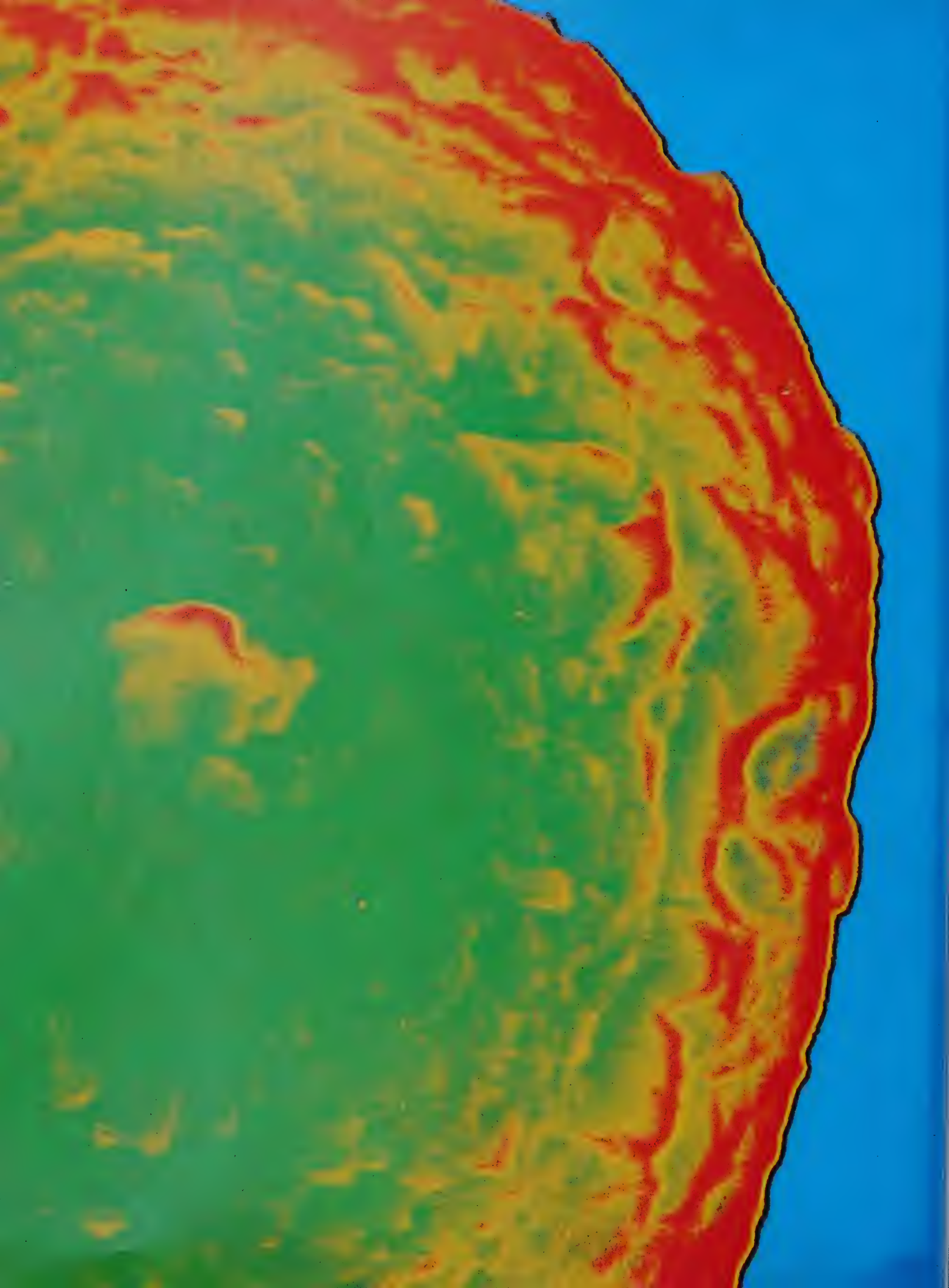




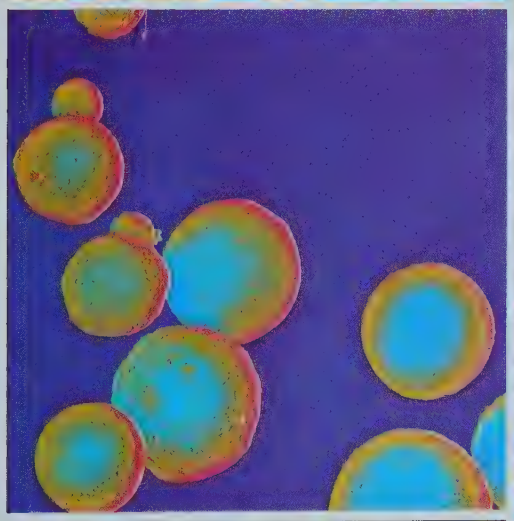
"In the 70s," Inco President Albert P. Gagnebin declared recently, "powder metallurgy will prove invaluable to industries on the frontiers of engineering. The applications of powders are limited only by the imagination. We have seen powders used successfully in animal feed, fungicides, magnets, filters, bushings, batteries, tire studs, coinage, cutting tools, welding electrodes, and on and on. Hundreds of new applications are waiting to be found."

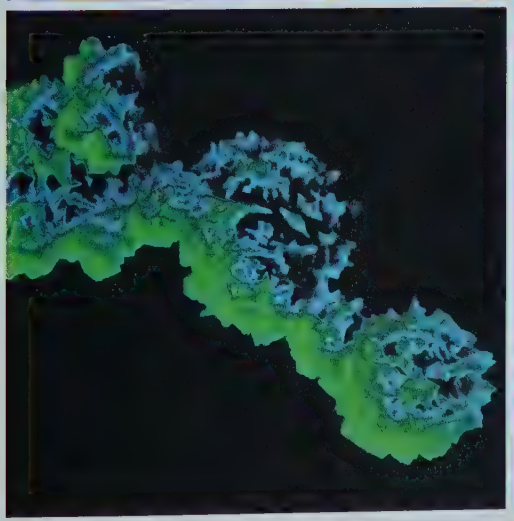
All metals are available in powder form. The powders are metallic elements or alloys in finely divided particulate forms which are produced by various methods, each conferring its own distinctive properties to the product. Metal powders are not chips or scraps of wrought materials. Many of their characteristics—chemical composition, microstructure, oxide content, particle size—are quite different from those of metals in more massive form.

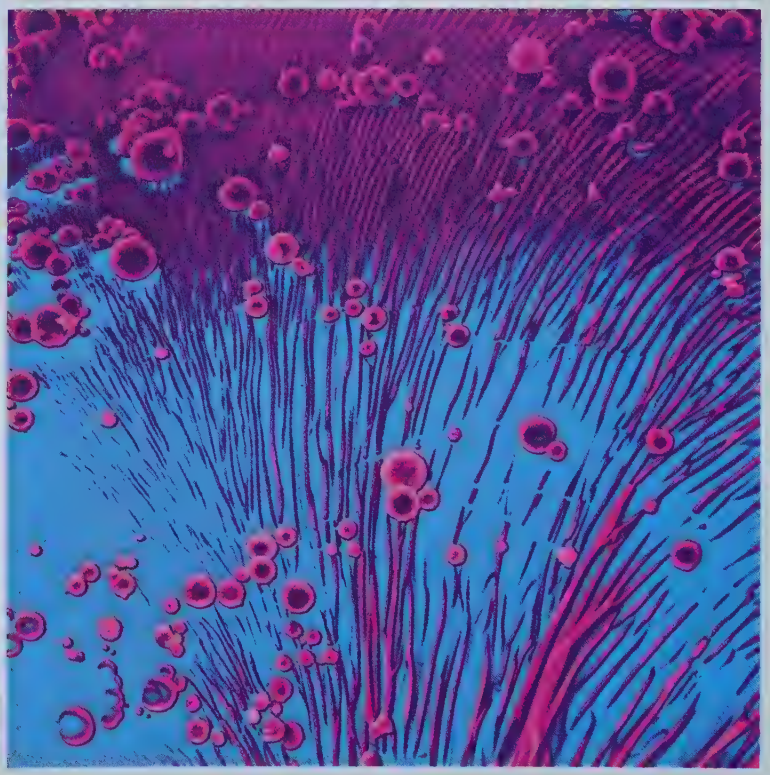
On these pages are some dramatic photographic representations of the microstructure of some high-quality nickel powders produced by Inco. The color transparencies from which they were taken were prepared from stereoscan micrographs by Robert Maynard-Smith, Chief Photographer of International Nickel Limited. The variety of microstructures not only provides some fascinating artistic creations, but indicates the variation in characteristics that makes nickel powders ideal for fabricating items from gears *(above)* to laundry machine stem inserts *(left)*—in fact, an almost infinite number of products.



Applications for metal powders run the full gamut of industrial and consumer uses. The most important application is the manufacture of structural shapes like gears or ratchets from metal powders by powder metallurgy. These stereoscan micrographs of nickel powders were prepared by the Metallurgy Department, University College, Cardiff, Wales, and the Metallurgy Department, University of Aston in Birmingham, England. Special color effects were provided by R. Maynard-Smith, Inco Limited.







FORMS OF NICKEL

What do metals look like? Most people can readily conjure up a mental picture of a gold nugget or a vein of silver. When it comes to nickel, however, most people are at a loss. A surprising number, in fact, think of the five-cent coin.

Coins have been, traditionally, one of nickel's most common uses. There are many others—stainless steel, nickel-chromium plating, a host of high-nickel alloys. But, significantly, everyone is familiar with *applications* of nickel—not nickel itself. What, then, does the metal itself look like?

Only a very small percentage of nickel-bearing ore is nickel. A long and complex extraction and refining process is required to obtain the nickel in pure form. Primary nickel is what emerges at the end of the milling, smelting, and refining process. International Nickel markets primary nickel in a variety of forms to serve varying customer needs. These include electrolytic nickel, nickel pellets, "SD" nickel, nickel oxide sinter, nickel shot, a general purpose nickel oxide, nickel powders, nickel chemicals, and several foundry addition alloys. This wide range of products gives Inco an important marketing advantage, since most other nickel companies produce only one or two nickel products.

Electrolytic nickel and *nickel pellets* are essentially the same high-purity metal, analyzing 99.97 per cent nickel-plus-cobalt or higher. Produced by different methods, they have different shapes. Electrolytic nickel, refined by the electrolytic deposition of the nickel from a refined solution of nickel chemicals, is sold in various-sized squares and rectangles. Well suited to the production of all nickel-containing alloys, it is the most widely used form of nickel in the basic metals industry. It is also employed in the plating industry. Nickel pellets, produced by the carbonyl refining process, are likewise a convenient form of the metal for all metallurgical purposes, including electrolytic plating.

A special form of electrolytic nickel known as "SD" nickel is also produced.

A development of International Nickel's research laboratories, this product has particular advantages in the electroplating industry as a result of a small, closely controlled sulphur addition that imparts greater electrochemical activity.

Inco also offers several high-purity *nickel powders.* Produced by the thermal decomposition of nickel tetracarbonyl, they differ primarily in particle size and shape and apparent density. They are used mainly to make high-purity nickel components and nickel alloys through powder metallurgy techniques.

"F" nickel shot is a finely divided form of nickel that is produced by quenching molten metal in water and screening to size range. Analyzing about 92 per cent nickel, its silicon, iron, and carbon content imparts a low melting point that gives it particular utility as a ladle addition in gray-iron foundries. "F" nickel shot may also be used as charge material in batch melting.

A dense, granular nickel oxide of about 75 per cent nickel content, *nickel oxide sinter "75"* is produced by fluid-bed roasting of nickel sulphide pellets. It is an economical form of the metal that is used advantageously in open-hearth and electric-furnace alloy steel processing — particularly of stainless and low alloy steels.

Nickel oxide sinter "90" is a newer, more refined oxide material that is obtained by additional treatment in fluid-bed reactors, notably chlorination to lower copper content and reduction of the oxide with hydrogen. About 90 per cent nickel, it offers broader utility while retaining the economic advantages of an oxide product.

Inco also produces a general purpose nickel oxide. Unlike the nickel oxide sinter products used for alloy production, it was developed especially for use in the chemical, catalyst, and ceramic industries. This high-purity, acid soluble nickel oxide is made from leach solutions in Inco's iron ore recovery plant.

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

United States
THE INTERNATIONAL NICKEL COMPANY, INC.

United Kingdom
INTERNATIONAL NICKEL LIMITED

Continental Europe
International Nickel Benelux S.A., Brussels
International Nickel France S.A., Paris
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International Nickel A.G., Zürich

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Australasia
International Nickel Australia Limited, Sydney

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Exploraciones y Explotaciones Mineras Izabal, S.A.
(Exmibal), Guatemala City
International Nickel S.A. (Proprietary) Limited, Johannesburg
P. T. International Nickel Indonesia, Djakarta

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Presenting A Medallion

One of the symbols of office of the mayor of Hereford, England, is a chain holding 22 medallions. The newest depicts a cold-rolling mill, modelled in relief in solid gold. It was formally presented to the city by Henry Wiggin & Company Limited, a producer of high-nickel alloys and part of the worldwide International Nickel organization. Wiggin has been located in Hereford since 1956.

Originally consisting of 15 gold medallions linked together, the chain was presented to the city in 1876 by a former mayor. Additional medallions and links have been added over the years. The Wiggin medallion, by bringing the total to 22, required a restyling of the chain, incorporating a cross-brace to reduce the over-all length.

In presenting the medallion on April 28, Wiggin Chairman John H. Reevy noted: "We are proud as a company to be given the privilege of presenting a medallion for the Mayoral Chain. We are especially proud of the fact that it will historically honor our Mayor, Councillor William Griffin, who is an employee of Henry Wiggin, the first to have filled this ancient office. He has done so most capably, and we are proud to commemorate his service to the City of Hereford."

Photographs by R. Maynard-Smith, Inco Limited

INTERNATIONAL NICKEL

MAGAZINE

1971/3

The Cover

A piece of art? . . . or sculpture? . . . or a design piece? In fact, it's the outside of a building—the IBM Building in Pittsburgh, Pennsylvania, built in 1962. Its exterior, save for window glass and gaskets, is nickel stainless steel.

Stainless steel's fame as a building material—for both exterior and interior—is worldwide. Traditionally, designers and builders turned to this material for its characteristics of strength, light weight, and resistance to corrosion. Increasingly, attention in recent years has focused on the design capabilities offered by this versatile metal.

The contributions of nickel-containing materials to our daily lives are everywhere. Where? In this issue are some fascinating examples of places where nickel plays a vital role: In one of the world's newest airports, whose advanced concepts of design are described by one of its creators, Paul Andreu, in *Planning An Air City* (page 11). In the structures and displays of international marketplaces, whose growing role is analyzed by a top authority, Carl Theodor Steidle, in *Do Trade Fairs Still Work?* (page 24).

But the nickel industry produces more than just nickel. Its "multiplier" effects in two widely separated parts of the world are explored by Alexander S. Ross *(Thompson: Ripples in the Canadian Pond,* page 18) and Alex Kerr *(Western Australia—The Growth State,* page 30).

INTERNATIONAL NICKEL MAGAZINE

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The International Nickel Company of Canada, Limited
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This quarterly magazine of the worldwide International Nickel organization is published in Canadian, French, German, Italian, United Kingdom, and United States editions.
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This is the second article based on a series of taped conversations in which H. Franklin Zurbrigg, vice-president in charge of exploration of The International Nickel Company of Canada, Limited, discussed Inco's search for new ores with writer Joseph R. Boldt, Jr. (right). *The main emphasis of the first article was on Canada and sulphide ores. This one is concerned chiefly with Inco's exploration overseas and oxide ores.*

JRB: Where outside Canada are you looking for sulphide deposits?

ZURBRIGG: In all places where we decide to explore, but commercial nickel in sulphide form is rare. The places outside Canada we think have the best potential for it include pre-Cambrian areas in the United States, Australia, and southern Africa, where important sulphide nickel deposits have already been found.

JRB: Does it follow then that much of Inco's very considerable exploration effort outside Canada is primarily for lateritic—oxide nickel—ores?

ZURBRIGG: Yes. Most of the world's reserves occur in oxide deposits—laterites—and future growth in the nickel industry will depend mainly on them.

JRB: What does that mean in terms of geography and geology?

ZURBRIGG: With respect to laterites, it means areas of ultrabasic rocks where tropical to subtropical weathering has produced residual soils that are nickel-bearing.

JRB: How are you organized geographically for this search?

ZURBRIGG: We have three field exploration divisions—North America, Australasia-Indonesia, and the balance of the free world—and these are subdivided intio regions, each with its own operations headquarters.

JRB: Does the North American division involve mainly Canada?

ZURBRIGG: Yes, in the sense that our Canadian program covers very large areas of Canada, whereas the areas being explored in the United States and Mexico are much smaller.

JRB: It's well known, of course, that Inco's search for metals in the United States has centred on Minnesota.

ZURBRIGG: Yes, our U.S. exploration group is based at Ely, Minnesota, where we have large low-grade copper-nickel deposits. We first optioned prospecting rights there about 20 years ago. After extensive exploration and evaluation work—including a 1000-foot exploration shaft and exploration drifts at that level, then

THE SEARCH II

An Indonesian worker tagging ore samples for testing, an Australian team raising a diamond drill rig into position—part of Inco's worldwide search for new sources of nickel.

a series of feasibility studies—we decided that it was not profitable to develop these deposits at the present time.

JRB: Why?

ZURBRIGG: Basically, it's a matter of grade. There are large tonnages, but they assay less than one per cent copper-nickel.

JRB: Do you expect the company will mine there eventually?

ZURBRIGG: There is no doubt in my mind that, because of the very large tonnages of copper and nickel, these deposits will be mined. When the time will be, I don't know.

JRB: What about nickel prospects in Mexico?

ZURBRIGG: Our studies give us no reason to think large commercial deposits of sulphide nickel will be found in Mexico or Central America, but that does not apply to oxide nickel.

JRB: Most everyone knows about the laterites in Guatemala. Do you hope to find others in Mexico?

ZURBRIGG: We're not encouraged to expect them there because although the right kinds of rocks are present in certain areas, the weathering history in those places has not led to the accumulation of lateritic soil.

In A Global View

JRB: How do you decide just where in the world you're going to search?

ZURBRIGG: Selection of overseas areas to be explored is essentially the business of staff geologists in Toronto, supported by regional staff geologists. They compile all available information on areas that could be of interest to us, having in mind geographical and general as well as geological considerations. They evaluate these and then recommend to the Director of Exploration that we explore

Long rows of core samples form pipe-like lines on the ground in Western Australia. Brought up by drilling, they will be sorted and subjected to an extensive series of tests.

selected areas.

JRB: These recommendations could involve widely scattered regions of the world. What does he do then?

ZURBRIGG: He reviews the recommendations with his senior staff, including the staff geologists, and with the vice-president in charge of exploration.

JRB: The final decision very much involves Inco's top management?

ZURBRIGG: Yes, every entry we make into a new country is the result of a policy decision by top management.

JRB: Particularly because of the political considerations involved?

ZURBRIGG: For other reasons as well.

JRB: Once you get a go-ahead—what happens then?

ZURBRIGG: After a project has been approved by senior management, after the necessary agreements have been executed, and the appropriate accounting and banking systems have been decided on, and after the Board of Directors has appropriated the required funds, the regional operations organization is established. The regional manager is appointed, a base for operations is selected, office space is rented, field personnel are assigned, field equipment is purchased, and then the search gets under way.

Our Principal Targets

JRB: Overall, of course, exploration outside Canada has grown into a very substantial program. Where is most of the money going?

ZURBRIGG: Our current principal overseas targets are in the Australasian and African areas.

JRB: Australasia includes?

ZURBRIGG: There are two subsidiary companies in that part of the world. One, International Nickel Australia

The earth cut away like a halved orange provides a geologist's view of New Caledonian terrain.


CANADA
Ely
Sudbury
MINNESOTA
UNITED STATES
MEXICO
GUATEMALA
SCALE OF MILES
0 500 1000 1500


SULAWESI
NEW GUINEA
PAPUA
SOLOMON ISLANDS
INDONESIA
AUSTRALIA
Rockhampton
NEW CALEDONIA
WESTERN AUSTRALIA
Kalgoorlie
Widgiemooltha
SCALE OF MILES
0 500 1000 1500

A wide variety of geographical settings emerges from these aerial views: (1) Pine trees in Minnesota; (2) Reddish splotches of laterite earth dotting the mountainous terrain of New Caledonia; (3) An exploration headframe dominating the sparse, dry landscape of Western Australia near Widgiemooltha; (4) Mountains, jungle, and coastal plains in Sulawesi.

Limited, is responsible for work currently in progress in Australia, Papua, Australian New Guinea, and the Solomon Islands. The other, P. T. International Nickel Indonesia, handles Indonesia.

JRB: These are presently two exploration companies?

ZURBRIGG: Most of their activity to date has been related to exploration, but they were set up in the expectation that mineral discoveries in Australia and Indonesia would be developed for production. They have responsibility for all of the company's activities in their respective areas.

JRB: You have not mentioned New Caledonia.

ZURBRIGG: The work in New Caledonia is being carried out by another company—Cofimpac, a French company with headquarters in Paris, in which Inco is a minority partner. The preliminary geological and exploration work was carried out by Inco. Then we and BRGM, a French government agency, jointly did the initial exploration to determine the deposits that should be mined. Once Cofimpac was set up, it took over the responsibility for exploration, but it has on loan the Inco man who was in charge of the initial work, and under him the man who was in charge of the sample preparation and assay laboratory.

Indonesia: An Ambitious Program

JRB: Having both sulphide and oxide nickel deposits, Australia seems to be quite interesting geologically.

ZURBRIGG: Australia checks out very well geologically and, of course, its political environment is attractive. As you know, we were involved in an oxide nickel deposit in Western Australia near a place called Wingelinna. Because it's in remote desert country, its development would have to support too much infrastructure to permit profitable operation. We had to give up on it.

JRB: What have you found in Australia that interests you?

ZURBRIGG: We have discovered a group of relatively small sulphide deposits in Western Australia. We also have an interest in a lateritic deposit near Rockhampton, on the northeast coast. We are continuing a quite large exploration program elsewhere in Australia.

Field geologists in Indonesia plan exploration.

The search for nickel involves varied techniques: (Above) *A geologist and his assistant look for outcrops in a Guatemalan river:* (Below) *An Inco helicopter flies above the coast of Sulawesi.*

JRB: It's no news that some parts of Indonesia have a geological environment that's favorable for nickel.

ZURBRIGG: We were, as you know, the successful bidder against a number of contenders for the rights to conduct exploration on the island of Sulawesi.

JRB: It's a big program, is it not?

ZURBRIGG: One of the most extensive we've ever undertaken. The contract area originally contained about 25,000 square miles. Approximately 1,300 men have been engaged in the various aspects of the operation, including geological mapping, surveying, sampling, assaying, road building, camp construction, and transportation.

Our work involves, on the one hand, investigations that lead to release within specified times of portions of the contract area and, on the other, appropriate sampling of laterite occurrences to determine their extent and nickel content. As a result, we have released land as required and have outlined important nickel deposits. Plans are now under way to bring one of these deposits, Soroako, into production.

JRB: What grade is considered to be ore?

ZURBRIGG: We think in terms of 1.5 per cent nickel—more or less.

JRB: The ore originally mined in New Caledonia contained as high as six and seven per cent, and even now averages close to three. No extensive laterites as rich as that have been found anywhere else?

ZURBRIGG: The high-grade ore you refer to underlies a blanket of lower-grade laterite that heretofore has been regarded as waste. Nearly all laterite deposits have this high grade-low grade combination to some degree. No matter where its operations may be, Inco intends to treat both grades—as a blend or separately. When we speak of a nickel content of 1.5 per cent, we mean an average of the two grades.

At ground level, the terrain's differences are even more striking: (1) Indonesian workers dig through Sulawesi earth; (2) A survey team marks off Australian land; (3) A bulldozer moves New Caledonian earth.

Then come testing and sampling: (1) Looking at ore samples brought up by a drill in Guatemala; (2) Examining a chunk of laterite ore in Indonesia; (3) Drilling into the soil of Western Australia.

JRB: But no extensive deposits as rich as New Caledonia have been found anywhere else?

ZURBRIGG: Not yet, at least in terms of quantity, but something resembling New Caledonia in a small way has already been found on Sulawesi.

JRB: You think there may be more?

ZURBRIGG: Yes, I do. We're encouraged with what we've already found and we are continuing our search.

JRB: You are also, you've indicated, searching pretty intensively in other parts of the world?

ZURBRIGG: Africa ranks next to Australasia in the magnitude of our effort.

JRB: You are looking for nickel there?

ZURBRIGG: As everywhere else, our primary search is for nickel.

JRB: You are also working in South America?

ZURBRIGG: We're doing some initial looking in Brazil, to determine if conditions there warrant an expanded operation.

JRB: And in Central America?

ZURBRIGG: Guatemala has been our centre of activity, but so far as exploration goes, we're well past the peak of effort there. It's a matter now of getting the deposits into production.

JRB: That completes our world tour?

ZURBRIGG: I've told you where we are active right now. Our staff geologists are always looking at other possibilities.

We Keep On Looking

JRB: The sum of it seems to be that the need for ever greater nickel production is transforming Inco from a Canadian sulphide ore producer to an about-to-become world producer of nickel from any type of ore you can find.

ZURBRIGG: Sulphide nickel minerals have been the lifeblood of International Nickel. But to meet our customers' needs for more nickel every year, we have to have lateritic resources as well.

PICTURE CREDITS

Pages 2, 3 (below), 4, 5, 6 (2, 3, 4), 7 (left, lower right), 8 (2,3), 9 (2,3): Lance Nelson
Page 3 (above): Eddie Lau, Inco Inc.
Page 6: Maps by Bernard Gervey
Pages 7 (upper right), 9 (1):
Fred Barnard, Inco Canada
Page 8 (1): Jim Wall, Inco Canada

During a visit to Inco headquarters, Dr. Soemantri is shown with Chairman Henry S. Wingate (left) and President Albert P. Gagnebin.

MOVING AHEAD IN INDONESIA

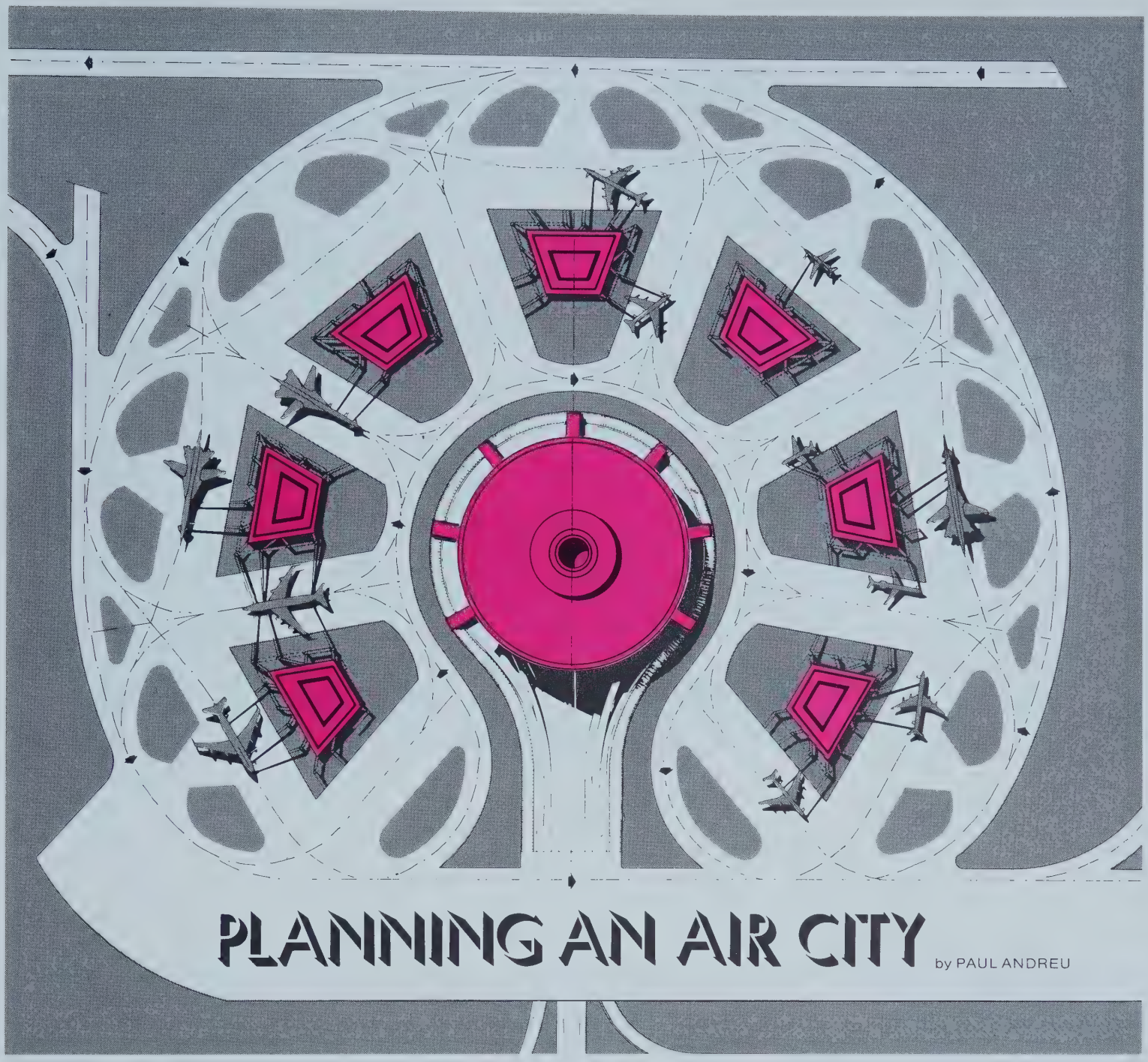
"P. T. International Nickel Indonesia, a wholly owned subsidiary of The International Nickel Company of Canada, Limited, has confirmed that it has located significant lateritic nickel deposits in the Soroako area of the island of Sulawesi and is making plans to proceed in stages with their development." This announcement, made in Djakarta on June 21 by Dr. Soemantri Brodjonegoro, Minister of Mines of the Republic of Indonesia, marks the most important stage to date of a search for nickel that began in 1968.

After preliminary exploration, drilling began in 1969. Since then, the company has drilled more than 1,900 drill holes—totalling 35,000 metres—in the Soroako area alone. Two bulk samples—one from the Soroako area and one from the Pomalaa area—each weighing 2,000 tons, have been shipped to Inco Canada's research stations and laboratories in Ontario, for both laboratory and pilot-plant testing. Work continues also on a development study covering engineering, marketing, financial, and processing elements for the proposed project. While certain preliminary work is currently under way, construction cannot begin until matters are finalized following completion of the development study—expected to be completed about the end of the present year.

It is presently contemplated that the first stage of the project would involve the construction of facilities to produce about 50,000,000 pounds of nickel per year in the form of matte, with initial production planned for the mid-1970s. Although capital costs for the first stage of the project and required infrastructure will not be defined until the development study is completed, a rough preliminary estimate indicates that they could be on the order of $200 million. The company estimates that it will have spent some $15 million by the end of 1971 on exploration and development activities.

The Contract of Work, entered into by the Republic of Indonesia and P. T. International Nickel Indonesia in 1968, provides for local Indonesian interests to be offered shares in the company progressively over a period of years. Additionally, Inco has recently held talks with Japanese interests regarding their prospective participation in the development of the Soroako deposits, inviting them to acquire an equity interest as well as to provide certain financial and marketing cooperation. International Nickel will be responsible for the design, construction, operation, and management of the project.

The present activities of P.T. International Nickel Indonesia employ some 1,100 Indonesians, including professional and technical personnel. The company has established a base at Malili, which includes a laboratory for testing and assaying ore samples, modern geological and administrative offices, and aircraft-landing facilities, as well as a school and a modern clinic.



PLANNING AN AIR CITY

by PAUL ANDREU

Paris is today building its third international airport, totally planned with a view to the exploding growth of air traffic in the year 2000 and beyond. And man—the traveller and the airport worker of the future—has been the main focus of the extensive planning.

The place for this 6-billion-franc project is Roissy-en-France, some 12 miles north of the French capital, and the task, begun in 1967, is one of gigantic proportions. The largest in continental Europe, the airport will occupy over 7,000 acres of ground—more than a third of the entire surface of Paris itself—2,000 acres of which will be laid with concrete. The outer fencing will run 22 miles around. On completion of the first construction stage in 1974, some 26 million cubic yards of earth will have been moved. Yet the true scope of the project is not reflected so much in the physical size of the effort as in the complexity of planning for a modern air city.

The planners, however, started with one advantage, which Paris enjoys over most big capitals of the world: a large, flat farmland region nearby, practically uninhabited (only one farm was expropriated to make room for the airport), and removed from any major population centre likely to suffer from aircraft noise.

The shape of things to come: The main terminal and satellite buildings

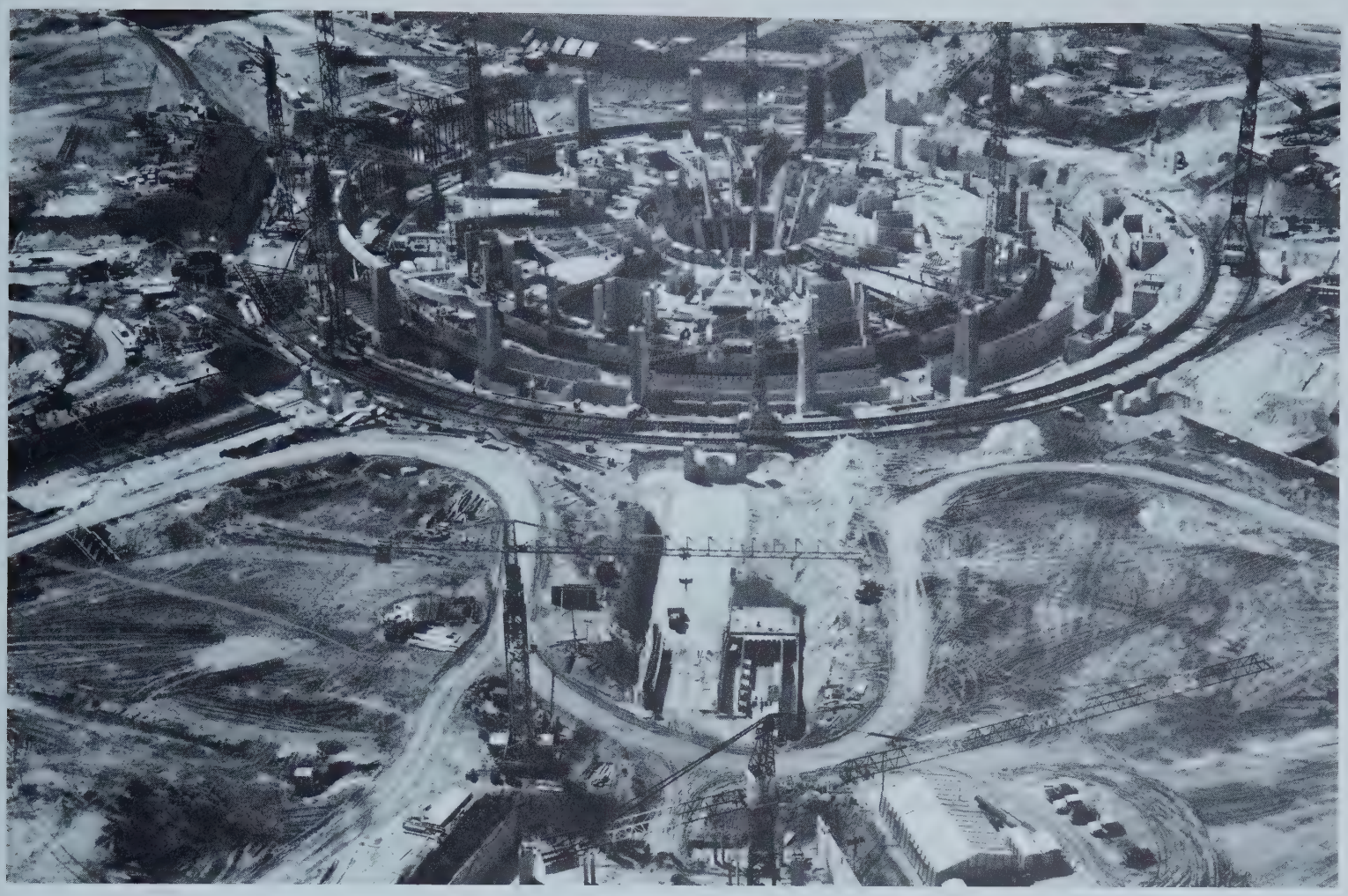
When the site was approved in August 1960, it was "frozen" for development and construction prohibited. The four 12,000-foot runways are aligned in a way that prevents overflying of any lived-in area at an altitude of less than 2,000 feet, either at take-off or landing. New and strict urban regulations have recently been introduced to combat acoustic nuisance, and Roissy will be well within the imposed standards. A wide area has been placed off-limits to housing construction. In fact, some communities that are now bothered by traffic from Orly and Le Bourget will at last find relief from noise.

Creating An Esthetic Experience

With Roissy, we had a nearly virgin territory in which to develop an original planning philosophy. Roissy has been conceived as a complete, dynamic, functioning city for transients, but also as a permanent working community (the airport will employ 70,000 people and create 40,000 new jobs in the area). It is designed so that all its individual elements may operate freely and yet work smoothly together. If we look "under the hood," Roissy is a huge modular machine whose purpose is to dispatch and receive passengers and freight efficiently, smoothly, and pleasantly; but it was our intent that the mechanics of efficiency should remain invisible, that only their effect be experienced. Therefore we have concentrated our efforts on designing a human environment suited to the specific purpose of the place and expressive of the spirit of air travel. The increased speed and capacity of modern aircraft, and the attendant growth of air traffic, raise serious technical problems of a quantitative sort, but these are really subsidiary to our main concern: the well-being of individuals in a mass situation. We do not want simply to "process" planeloads of people, but to create an "esthetic" experience for modern man, something of a rare thing in today's world.

Another guideline in our planning has been to build in as much flexibility as possible to allow for future technological developments in air transportation, such as improved navigational and landing procedures.

The new airport is to absorb the fantastically increasing volume of air travel and air freight of the coming decades. This is expected to double every five or six years for passengers, and every three or four years for cargo. Presently, the two existing Parisian airports, Orly and Le Bourget, together handle 12 million passengers a year. Le Bourget, the older of the two, famous as the landing site of Lindbergh's *Spirit of St. Louis* in 1927, and also as the home of the International Aeronautical and Space Exhibit held every two years, will be phased out progressively, except perhaps to accommodate future STOL (Short Takeoff and Landing) aircraft. Orly, today Paris's main international airport, even after completion of its major expansion program, will be unable to accept more than 16 million passengers a year, nearly double its present load. Roissy will gradually assume the main role by taking over 5 million passengers (an average of



The massive project under construction

27,000 a day) and 550,000 tons of freight in 1974; 30 million passengers (80,000 a day) and 1,380,000 tons of freight in 1980; 50 million passengers (140,000 a day) and 3,100,000 tons of freight in 1985. By then it will handle almost five times as many passengers and 10 times as much cargo as Orly did in 1970.

With the massive advent of jumbo jets, passengers will be arriving in bunches of 500 or more at a time, turning the airport into a veritable railway station and making a completely new type of organization necessary. The problem of accommodating and serving such a huge transient population really begins with the question of ground transportation between city and airport, the traditional bane of air travel. To provide easy access to and from Roissy, by road and rail, we have helped the *District de Paris* work out a local development plan on the appropriate scale. Roissy is destined to become the hub of the most important and active centre in the Paris region, with the building of new cities and new industrial complexes, some linked to the airport's activity but most of them generated indirectly. Needed will be 120,000 new housing units for a population of 385,000. This implies planning on a grand scale, and before we could even consider the engineering problems raised by the airport, we had to work out its future regional setting. Within this large framework, a major network of ground transport facilities was designed to serve the needs of both the newly established communities and the airport's customers and personnel. All in all, daily local traffic in 1985 will consist of 140,000 travellers (plus the visitors), 70,000 airport workers, and 40,000 people otherwise employed in the area; the last two categories will be making two-way trips between home and work each day. Add to this the load of merchandise traffic, possibly 5,000 trucks a day, not counting the supply needs of the local population and local industry, nor the vehicles passing through on their way to other destinations.

A Diversified Transport System

A huge road construction scheme has started and is being implemented parallel with the building of the airport. A new network of six-lane superhighways is being developed that will completely change the road map of Paris's surroundings, encircling the capital and merging at Roissy, with an hourly capacity of 12,000 vehicles. Within the perimeter of the airport itself, passengers and visitors will have exclusive use of nine miles of highway, including 17 overhead interchanges, where the average driving speed will be 60 miles per hour.

Yet automobile traffic, no matter how good the road infrastructure, has inherent limitations; we recognized the necessity to diversify the transport system. Several possibilities are at hand.

One is a 12-mile extension of the Paris subway *(Metro)* lines to Roissy, two miles of which would run within the compound of the airport itself. Another is the construction of a new RER link *(Réseau Express Régional),* the supermodern, all-automated, extra-fast subway system which radiates from Paris into some of the suburbs. The third solu-

Tallest in the world: Roissy's control tower under construction

tion is a new railway line, designed for travel at speeds of 75 miles per hour. But the most sophisticated and perhaps the most attractive project involves a 34-mile-long shuttle service by hovertrain between Orly and Roissy, including a central stop in Paris with connections to the city's various other public transport facilities. This would be a vehicle supported and guided by an air-cushion and electrically driven, thus producing neither noise nor polluting gases, with a cruising speed of 125 miles per hour.

The access system by road will be integrated in the very structure of the air terminal building at Roissy airport. The rail network will converge on the so-called Central Unit, from which a local, internal transport system, consisting of an automated mini-subway, will offer connections to the air terminal and other airport facilities.

Parking for 4,000 cars is provided for passenger use on the upper levels of the terminal building, while outdoor facilities are available to visitors and employees for an equal number of vehicles. Access to the airport is organized in such a way that passengers and non-passengers are funnelled separately: passengers will drive right into the air terminal; they will receive computer-delivered instructions on entering; they will check in and register their baggage directly from their car; they will then drive up to one of the four parking terraces. The entire procedure will not take more than 15 minutes. At a later stage in the program, five different terminals will be available to the public, providing a grand total of 20,000 covered parking places.

Impressions In Motion

Our concern, when designing the access pattern, went far beyond that of mere logistics. We also wanted to give the traveller a sense of dynamic visual discovery on the way. The approach to Roissy, whether by public or private means, will lead the eye to a succession of dramatic "pictures" of the airport. To create these "impressions in motion," we mapped out itineraries for the various approaches which, as you wind your way to the air terminal, present you with a special view of each main architectural element, in its best possible perspective. Every twist of the road reveals the most striking feature of a particular building. Each in turn becomes the main point of focus in this controlled visual setting, the others being momentarily used as background or retreating from sight altogether. At night, the differently tinted lights make the process of dynamic discovery and the visual point and counterpoint effect even more meaningful by playing on the different values given to the respective structures.

To allow for this subtle integration of infrastructure and architecture, we developed what may appear, when considered statically on the map, like a very loose, almost haphazard, ground-plan for the distribution of our buildings. Everything, however, falls into place when you begin moving through it at ground level. In fact, to feature each element as it deserves, we have avoided the temptation to bring things massively together and build an airport on a monumental scale.

Because of the changing perspective under which Roissy is intended to be viewed, the buildings fall into varying relationships to each other. Their individual designs take this fact into account, although we have kept within a defined set of forms. A sensitive viewer will probably understand their symbolic intimation and their relevance to the passenger's state of mind; in any case, it will

be felt "subliminally." Psychological studies conducted on air travellers show that they subconsciously experience flying as a situation where man transcends and goes beyond himself. Moreover, the old Icarus myth is ever-present in us; flying is still felt as a godly prohibition that we transgress. This is the sort of awareness that guided us in our design work.

Maximum Concentration Of Functions

The main terminal is the heart of the Roissy complex. It is one of the first such buildings to concentrate so completely the essential functions of an air terminal: free and intimate communication with the outside, easy inside parking, fast-working passenger and baggage check-and-weigh facilities, and direct access to planes.

A circular structure 650 feet in diameter, 10 stories and 175 feet high, the terminal has a central core actually engirdled by the primary road system, which moves right into the heart of the building, around and up its whole height, then spirals down again and out. Thanks to this open-ended traffic ring, we are doing away with the need to stop at the terminal entrance, discharge passengers and bags, find a parking space away from the building, return... in short, with the familiar inconveniences. Our idea is that an air terminal should be a place of direct interchange between car and airplane; that time, distance, and bother between these must be cut.

Below the parking tiers are three so-called "traffic" levels: these, in addition to the traditional "arrival" and "departure" floors, include a "transfer" concourse for immediate access to any one of seven "satellite" buildings from which passengers embark on their flights. These three tiers are connected by overhead rolling sidewalks, crisscrossing the open well at the centre of the building in transparent glass-enclosed tubes, and moving at an incline. The hollow core of the building is a major organic element of the structure; not only does it provide the space for the overhanging conveyors, it is a source of natural lighting and ventilation. Below ground are two more levels: one contains shops, snackbars, and a restaurant, as well as the future mini-subway station; the furthest down houses the baggage sorting system.

Our basic concept has been to handle the planes, the embarkation and loading operations, in direct contact with the terminal, and to achieve the maximum concentration of all the usual airport transactions, including passport and customs formalities. As a result, Roissy can handle the same number of passengers as Orly with only half the required walking distance. Eventually, there will be four other passenger terminals, not necessarily designed along the same lines as the first. Instead of one monster air terminal for 50 million passengers a year, there will be five separate ones for 10 million passengers each.

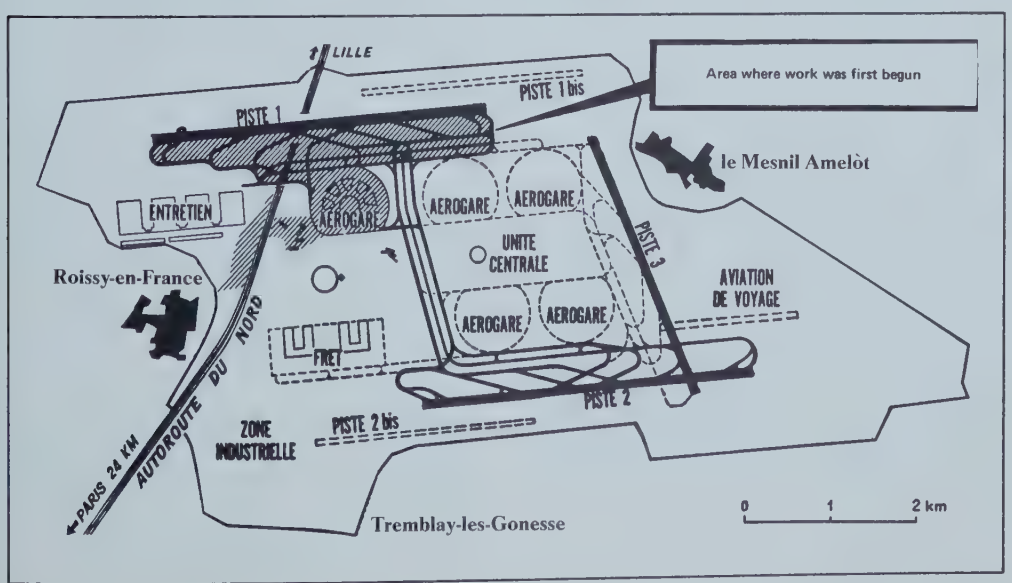
The seven "satellites" that orbit the terminal building are the final waiting stations before embarkation. They serve as separate drains for the main passenger flow. Each is connected to the terminal building by two underground channels, one a moving platform for passengers and the other a passageway for the transfer of luggage, and leads to the waiting planes by telescoping gangways. The planes are docked along three sides of the trapezoid-shaped satellite, so that we get a two-stage coil effect: the seven satellites surrounding the air terminal, and the aircraft surrounding the satellites. This double helix acts as a shock-absorber for the incoming and outgoing passenger flow. In addition, there will be no need to push and pull up the planes to nose-in position and this will save the airlines a great deal of manoeuvring, not to mention time.

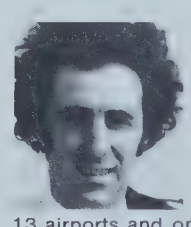
We wanted a dramatic contrast in feeling between the terminal and its satellites. The former is self-enclosed, inner-directed, and revolves around its central pit. The satellites open outward through large bay windows. To the traveller, this is the beginning of the journey; he feels he is stepping into the sky.

Other elements of the airport include the 1,000-acre freight zone; the maintenance area with a length of hangars totalling 11,800 feet; the air navigation centre; the 260-foot control tower, highest in the world, built by a method of sliding formwork; the so-called Central Unit, the terminal for rail communications with Paris, which contains hotels, restaurants, and shopping centres; the water tower, an architectural achievement in itself and one of Roissy's most remarkable landmarks; the power plant; the administration and other service buildings.

As airplanes get bigger and faster, as mass transportation tends to become increasingly dehumanized, Roissy should emerge, amidst the numbers and the rush, as a transit point in modern life where individual man, and his feelings, still have their essential place.

Shaded areas in this ground plan for Roissy indicate where work is already in progress.





Paul Andreu, chief architect for the Roissy project, is head engineer of the architecture department of The Aéroport de Paris. This airport authority is in charge of designing, building, and running all civilian airports within a 30-mile radius of Paris. This currently includes 13 airports and one heliport. The authority has also acted as engineering consultant for airport construction to 30 different governments—in Asia, South America, and Africa. M. Andreu attended the Ecole Polytechnique and the Ecole des Beaux-Arts, and is an engineer of the Ponts et Chaussées, the famous civil engineers institute.

PICTURE CREDITS

Photographs courtesy of Aéroport de Paris
Author's photograph: Jean Cassan

EQUIPPING AN AIRPORT

The most destructive element in any modern airport is people. Twenty-four hours a day, 365 days a year, passenger and baggage handling equipment is subjected to a constant battering. It must be highly functional in design, reliable in operation, and resistant to both accidental and wilful damage. To meet these needs tough, strong, easy-to-clean nickel stainless steel has been adopted by many airport authorities for the wide range of equipment essential to the efficient handling of people and their luggage, as well as for windows, doors, and other furniture exposed to continuous use and abuse.

Out on the tarmac, nickel stainless steel tankers ensure the purity of fuel and drinking water delivered to aircraft and collect liquid waste, while stainless steel passenger coaches speeding between city terminals and the airport retain their gleaming good looks with minimum maintenance—just an occasional washing with soap and water.

In buildings and vehicles, the high strength and corrosion resistance that nickel confers on stainless steels are enabling new design concepts for good-looking, lightweight, long-life structures to be developed—structures combining low maintenance requirements with economic initial cost.

PICTURE CREDITS

(Above) Rinaldo Piaggio, S.p.A., Genoa
(Below, left) Iberia Airlines
(Below, right) R. Maynard-Smith, Inco Limited

Along with the world's largest helicopter and the first two SSTs, visitors to this year's air show could see graphic evidence of Inco's many contributions to aerospace engineering. Nickel alloys and nickel steels play an essential part in the construction of aircraft, space vehicles, and instruments.

WORLD'S PREMIERE AIR SHOW

There always has to be a biggest and best in everything, and few experts would deny that the biennial Paris Aeronautical and Space Show at Le Bourget Airport has grown into aviation's most comprehensive, exhilarating, and exhausting event. Where else in the world can the two superpowers be seen in such friendly confrontation, sharing common ground and common air space to exhibit their wares, and taking the security wraps off their latest aircraft to the extent of parking them cheek-by-jowl, needle nose to backswept tail, in an overcrowded aeronautical parking lot through which the general public can freely stroll, comparing the advanced technology of East and West, rivet by expensive rivet? Where else can 14 smaller nations be seen displaying their not-inconsiderable aerospace skills both earthbound and in flight, giving a foretaste today of some of the commonplace features of tomorrow—supersonic air travel, vertical take-off, and variable geometry (or, more popularly, "swing wings")?

Where else but at Paris would the world's largest helicopter fly in from the Orient, unheralded and hitherto unknown outside its country of origin? And where else would this event be matched by the arrival from across the Atlantic of the world's largest airplane—the majestic C-5A Galaxy transport—vast in size but impressively lively in performance? What other air show could stage bill-toppers like the world's first two SSTs, the Tupolev 144 and Concorde—and those highly newsworthy tri-jets, the DC-10 and L-1011 TriStar, together with a full-size mock-up (and some of the hardware) of their European competitor, the A-300B Airbus? And where else could press and V.I.P.s go joy-riding at over twice the speed of sound? Small wonder that the 1971 Paris Show, held May 27 to June 6, drew some 950,000 visitors and 590 exhibitors.

Experts and laymen came, not only to watch the flying, but also to visit the great static exhibition of spacecraft, aero-engines, airframe parts, and accessories that occupied well over half a million square feet of Le Bourget's permanent exhibition buildings. Here the visitor could see something of the extraordinary complexity and ingenuity of the multitudinous pieces of equipment that go to make up every aerospace product, and could probe deeper into this fascinating industry that taxes man's inventive capabilities to the uttermost. For many thousands of air enthusiasts all over the world, Paris in springtime continues to hold an exciting if unromantic connotation—Le Bourget Airport.

PICTURE CREDITS

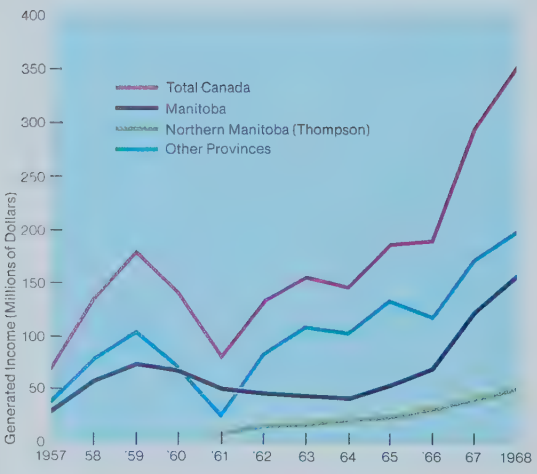
(Above) Thomas d'Hoste
(Below, left) UPI
(Below, right) K.J.A. Brookes, Inco Limited

THOMPSON

Ripples in the Canadian Pond

by ALEXANDER S. ROSS

An equal share of the donut
Is a mining town's true role.
The company keeps the edible part,
But we get to keep the hole.



"The Ripples"—the multiplier effect of the Thompson development.

A scandalous piece of doggerel to be sure, but it summarizes a notion that has always enjoyed credence in Canada: that mining—and by implication, all the resource industries—doesn't generate sufficient side benefits. Someone, usually someone from outside Canada, starts a mine. A town springs up beside it. There is an immediate boom in construction. When the mine is operating and the construction workers depart, employment tapers off. When the mine runs out of ore, or when economic conditions change, the mine shuts down. The company retires from the field with its profits intact. In the meantime, the public has gained far less, in terms of jobs, income, and tax revenues, than they would have if a secondary industry had been established instead. End of mining town; end of scenario.

It is in fact the plot line of an uncomfortably durable image of Canada's resource industries and it is this which lends particular significance to a recent study by Hedlin Menzies & Associates Ltd., Toronto-based economic consultants, on the side effects of International Nickel's development at Thompson, Manitoba.

Counting The Ripples

The study, commissioned by Inco, attempted to assess the impact of the mining and processing complex at Thompson on employment, on regional development, and on government revenues. Its findings startled Hedlin-Menzies President Ralph Hedlin, a man who is not easily surprised. "Frankly," he says, "I didn't think the side effects of the Thompson development would turn out to be this large. A project such as Thompson, in economic terms, is like dropping a pebble into a pond. Our job was to count the ripples—and I myself hadn't anticipated that the ripples would extend as far as our study indicates."

In itself, the Inco development of Thompson is a contradiction of the old "donut" myth. It was from the start more than just another mining operation; there is a smelter complex there as well and in 10 years Thompson has become a municipality of more than 20,000 people. And rather than build a company town, Inco went to elaborate lengths to persuade existing levels of government and the workers themselves to create a planned, durable community of which the company itself was just a component—perhaps the biggest such, but a component within a community structure nonetheless.

The immediate suspicion, of course, will be that Inco's sponsorship of the Hedlin-Menzies survey of Thompson invalidates its findings. Maybe so, as far as using the survey as fodder for political debate is concerned. But that wasn't the study's primary purpose. It was, according to Ralph Hedlin, "an honest attempt by the company to find out some facts that everybody needed to know. I suggested to Inco that the survey would be useful. They agreed, and asked us to go ahead. We did, and Inco people sure weren't looking over our shoulder while we researched it. Hell, we're not anybody's tame economists. We can't afford to be."

The Hedlin-Menzies researchers were not too tame, at any rate, to draw attention to several aspects of the Thompson operation that are a serious embarrassment to the company. Their analysis of per capita income statistics, for instance, reveals that "a substantial number of those indigenous to the area (of northern Manitoba) have not as yet been able to avail themselves of the increased economic opportunities in the region." They also draw attention to a "highly volatile" section of Inco's Thompson labor force which has a

monthly turnover rate of 10-15 per cent. Statistically, this means Inco must hire the equivalent of an entirely new staff every seven months, yet the dislocation is nowhere near as extensive as the figures suggest: most of the "in-and-outers" are footloose bachelors or men who moved north without their families. Married men who take jobs in Thompson and move there with families usually stay.

The Multiplier Effect

The most encouraging findings relate to the "ripple-in-the-pond" effect—the additional income which the economy has generated as a result of Inco's capital investment. If you include the money spent on the Canadian National Railways spur line from Sipiwesk to Thompson, and Manitoba Hydro's Kelsey generating station—both essential and integral components of the Thompson development—the capital investment since 1958 amounts to $500 million.

On top of that, Inco spent nearly $350 million on operating expenses between 1958 and 1968—about 80 per cent of it in Manitoba. These expenditures, the Hedlin-Menzies report notes "are stable enough in their recurring pattern to establish a group of efficiently operating suppliers, contractors and subcontractors in Manitoba and other parts of Canada." Nearly half of Inco's suppliers in Manitoba, the report adds, set up their businesses *after* the Thompson project was launched.

Thus the "multiplier effect."Although Inco has spent more than $800 million on the project in capital and operating costs, the *total* income generated throughout the Canadian economy amounts to more than $2 billion. Every dollar that Inco has spent on capital investment has caused *three additional dollars* to be spent by other Canadian firms and individuals.

The multiplier effect on employment has been even more pronounced. There were 6,590 people working in Thompson in 1968—half of them directly for Inco, another 25 per cent in Inco-related construction projects. But the number of jobs generated by the project elsewhere in Canada, the report estimates, totals 18,000! For every person on the Inco payroll, in other words, there were four other people holding jobs that are directly or indirectly dependent on the Thompson project. This total should *not* decrease significantly, the report adds, when construction at the site is completed, because anticipated increases in nickel sales should maintain national income and employment at close to their present levels.

Another remarkable finding of the study is the extent to which the economic "ripples" radiate beyond Manitoba's borders. Although Inco in 1968

Jack A. Cluff has been a mining sales engineer for 22 years with Manitoba Bridge and Engineering Works, a division of Dominion Bridge. Annual sales to Inco's Thompson operation—the company's largest customer—are well in excess of $1 million. Among products that MBE manufactures or builds for Inco are mine cars, cyclones with stainless steel linings, rock bolts, and wheels.

Tom Smerchanski and his two brothers founded Border Chemical in Transcona, Manitoba, in 1958. Today the firm is a major supplier of sulphuric acid for the Thompson operation, shipping it in their own fleet of jumbo rail tank cars.

George E. Whitbread, President of Metropolitan Investigation and Security (Canada) Ltd., had 22 years of active service with the Royal Canadian Mounted Police. Starting with three men in 1958, Metropolitan now provides 40 security officers for Inco's Thompson operation—the service's largest single client.

Arthur W. Dowse and his son, Frank, head Dowse Woodwork Ltd., of St. Boniface, Manitoba. When the Thompson operation started, Dowse went into industrial woodwork and later started a plant in Thompson to assemble refinery components made in the St. Boniface plant. Today there are 20 Dowse employees in Thompson, in addition to another 75 in St. Boniface.

accounted for almost five per cent of Manitoba's Gross Provincial Product, other provinces benefited as well. About 32 per cent of Inco's capital expenditure and about 21 per cent of operating expenses were spent in provinces other than Manitoba.

Government benefited too. The study shows that the Thompson project, since 1958, has generated provincial and federal tax revenues of nearly $325 million. These are revenues that wouldn't be available if Thompson didn't exist. The federal government took most of it —$240.5 million between 1958 and 1968. The provincial government collected nearly $40 million during the same period.

Plenty Of Boom

The study also explores the extent to which Thompson is subject to the "boom-and-bust" fluctuations that have characterized so many Canadian mining developments in the past. The conclusion, based on an analysis of revenue and expenditure statistics, is that there has been plenty of boom and remarkably little bust. According to the nationalist scenario, employment and generated income are supposed to decline dramatically once a mine's construction is complete. Thompson, however, has been in an almost continual state of expansion ever since it opened.

The chart on page 18, in fact, indicates that the project has achieved a degree of momentum on its own, quite apart from construction. The lines on the graph are estimates of income generated by the project for all of Canada, for Manitoba, for the Thompson area, and for other provinces.

You'll note that there's a sharp dip between 1959 and 1961, which coincides with the end of the initial construction phase. (The mine commenced production in 1961.) Notice, though, that the decline wasn't nearly as steep for Manitoba as it was for Canada as a whole; this indicates that the income-generating benefits of mine construction extend well beyond provincial borders. In Manitoba alone at least $1 billion in income was generated by the Thompson development by 1970.

Are Thompsons Outdated?

The townsite itself is another important generator of jobs and income. Company policy has aimed at creating an autonomous community that is as unlike a "company town" as a one-industry town can be. Nevertheless, Inco contributed a total of $14.5 million to community services between 1958 and 1968. Another $46 million was spent on homes and institutional construction, and another $10 million on commercial buildings in the same period.

Was this expenditure really necessary? Ralph Hedlin, for one, is beginning to wonder. He is on the board of directors of two northern mining firms, and a full-time thinker on the problems of development in Canada's North. Hedlin is beginning to question whether, from a corporate point of view, instant communities such as Thompson are really the wave of the future.

"The hovercraft is here. The VTO (vertical takeoff) airplane is almost here. It's now possible, in other words, to staff mines in the far north with *commuters*," he says.

"You can fly a planeload of miners from Edmonton to almost any place in the mid-north in less than two hours. So why not do it? Have the men work four 10-hour shifts and live in *nice* bunkhouses, then fly them back to their

families in the south for a long weekend.

"I mean, why should we move families and infrastructure out to some remote area when, in a lot of cases, we can keep them back in Edmonton or Winnipeg, where the amenities are? Inco's labor turnover rate suggests that, even though Thompson is one of the most successful, best-planned northern communities in the world, there are still a lot of people who don't want to live there. So why not let them live where they'd prefer to be?

"Now, we don't mention this in our report. I'm not saying that we should do this. As a Canadian who's interested in northern development, I think commuter mining would be bad public policy. But it *could* be done, you know..."

A Really Amazing Contribution

Hedlin's private thinking underscores a point stressed in the report: projects such as Thompson achieve "spatial development" without costing taxpayers a cent. Thompson's realization, the report says, "has brought about an important 'stock' of infrastructure and a climate of technical dexterity, and has established a bridgehead of the Manitoba economy. These advantages, moreover, have been obtained at no net costs to the federal or provincial governments."

The report warns against proposed changes in federal tax policies that might undermine the mining industry's contribution in this regard, and concludes with a recommendation that the next step in Thompson's development should be to provide the city with a broader economic base. Secondary and tertiary industries are needed to "strengthen the regional economy against adverse economic conditions in the United States, or in the metal sectors of export markets," the report continues. Since the federal government receives the largest share of revenues generated by the Thompson development, it may be appropriate for Ottawa to protect its "investment" by giving assistance that would expedite this development process.

So there, for once, are the facts. But what do they add up to? Hedlin, an outspoken man, sums it up this way: "Certainly the mining companies should bear an appropriate share of social costs, but elected people have a tendency to look on the mining industry as their milch cow. Perhaps that's because the industry has such a neanderthal image—the public is getting accustomed to thinking of mining companies as exploiters and polluters and nothing else. But what the study underlines, I think, is the really amazing contribution that these companies make in terms of employment and regional growth and expansion. These are critically important areas. What the study shows, I think, is that you really can't fault the industry on that score."

Jim McBride, President of Transair-Midwest, inaugurated direct jet service for Thompson a year ago. The growing airline now has three daily round-trip jet flights from Winnipeg to Thompson.

PICTURE CREDITS

Photographs by Horst Ehricht
Author's photograph by Legg Brothers Limited, Toronto

Alexander S. Ross, one of Canada's best-known writers, is associate editor of *The Financial Post*, for which he writes a weekly column of penetrating and frequently astringent comment on the nation's commerce and industry.

NINE-DAY MARKETPLACE FOR THE WORLD

For the last nine days of April each year, Hanover, Germany, becomes a magnet for businessmen from all over the world. On a 190-acre site on the outskirts of the city is the Hanover Fair—Europe's largest international trade fair.

This year 5,770 exhibitors representing 33 nations attracted some 600,000 visitors from more than 100 countries. From fertilizers to fuse elements, from cranes to cutlery, from precision tools to pottery, the Hanover Fair is a showcase not just for Germany but for all industrialized countries.

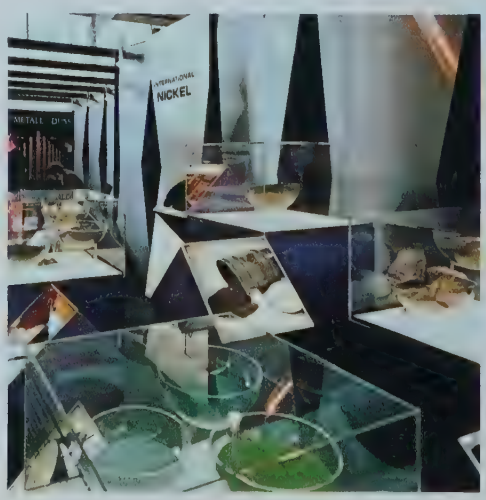
Since 1947, when the first German fair since World War II opened its doors in Hanover, the area occupied by exhibition stands has increased by more than 1,000 per cent—to 2,670,000 square feet. Large exhibition halls along spacious avenues are devoted to different technologies—the most recent serving the computer industry. Many of the stands, both inside the halls and outside, are permanent structures—exciting modern constructions with gleaming facades of nickel stainless steel, glass, and other dramatic finishes. The fairground has its own ten-track railway station, a helicopter link with the local airport, and parking facilities for 50,000 cars, as well as restaurants, conference halls, and even a swimming pool.

Classification of the Fair's exhibitors by industrial groups presents a statistical panorama:

Electrical engineering	1,620
Mechanical engineering	1,536
Office furniture and equipment	633
Iron, steel, and non-ferrous metals	206
Chemicals and plastics	155
Precision engineering and optics	138

To these, add exhibitors of a wide variety of consumer goods. Co-ordination of exhibits with a common technological link offers to the visitor maximum choice and maximum opportunity to obtain information.

A bird's-eye view of one small area of the Hanover Fair's 190-acre site, and flags representing the 33 nations that participated in 1971.



International Nickel has been represented at the Hanover Fair for the past 13 years. This year, in the hall devoted to Iron and Steel and Non-Ferrous Metals, Inco displayed its nickel products for many types of technical applications as well as publicizing the many additional services—such as product research and development, market development, and the provision of technical assistance—that International Nickel offers its customers.

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A rhythmic nickel stainless steel sculpture (1) contrasts with the unusual stainless steel panels cladding Deutsche Edelstahlwerke's permanent pavilion. A specially designed open-air film projector (2) features the products of Stahlwerke Sudwestphalen whose pavilion (5) is also clad in nickel stainless steel. The same material is used to achieve impact by Edelstahlwerke Buderus (3) and August Thyssen-Hütte (4), while Klöckner-Werke (7) created a fascinating effect with constantly moving circular panels of this gleaming metal. Sintermetallwerk Krebsöge's display (6) of sintered components includes some utilizing nickel powder.

Photographs by R. Maynard-Smith, Inco Limited

DO TRADE FAIRS STILL WORK?

by CARL THEODOR STEIDLE
Executive Director, Frankfurt Fair Authority

"European—and particularly German—fairs are backed by centuries of tradition." Although the view shown below (1) of the Frankfurt Fair today presents a sharp contrast to the depiction (left) of the Römerberg of Frankfurt am Main during a Fair in 1696, these fairs have, over the centuries, shown a "continual and practical capacity to adjust to the needs of the market."

"There is no patented recipe for organizing an international fair... The big international fairs (like the Fiera internazionale di Milano, 3) have become larger and more complex. This has led to specialized, or 'departmentalized', fairs. The Salon des Arts Ménagers, Paris, (2) is traditionally a popular attraction for French families who come to see the latest models of kitchen equipment. This year was the second Euroflora exhibit to be held in Genoa (4). Some 500,000 visited 270 Italian stands, along with 151 from 18 other countries. The famous international Salon de l'Automobile (5), held yearly in Paris, had 1,350 exhibitors in 1970. In recent years, the International Brussels Fair has been organized into a number of different shows and exhibitions, like the International Industrial Equipment Exhibition (6).

In our modern economic system, of what value is participation in trade fairs? How often and how earnestly this question is argued among economists and in the press, particularly from a cost-cutting viewpoint! What are some of the "plus" factors in this debate?

At regular intervals—timed to suit the cycles of production and sales in whatever line of business is involved—trade fairs afford an over all picture of what the various branches of industry have to offer. From what occurs at the fairs, a wealth of additional marketing information is made available. All this is compressed in space and time.

Moreover, exhibiting at a fair or visiting a fair leads to additional marketing opportunities. The large number of interested representatives, customers, and colleagues who meet one another at these events point the way to future business.

Opportunities For Information

The marketing aims of business that can be fulfilled by exhibiting at, or attending, a fair cover the entire range from an initial sales test of a new product, or even simply its prototype, to the conclusion of a sales contract in black and white. Fairs thus impinge upon a much larger spectrum of business activity than is often assumed.

By no means are international fairs exclusively instruments of promotion; in most cases, they represent more than just markets for buying and selling. The information and experience gained from them can influence the entire marketing strategy of a firm—and even how it may choose to develop its products. At the same time, a high value should be attached to the opportunity to make immediate comparisons—not to mention the fact that, at a fair, people have the chance to inform themselves in a completely free manner, without obligation, in contrast to calling on companies at their plants or offices.

Visitors can gain a comprehensive over all picture of what is being offered

and what the latest state of development is, and from all they have seen, can draw their own conclusions about further developments. They can talk about prices and terms of delivery, and about opportunities for import or export. They can compare everything on display in all respects, not least with regard to quality, and they can check to see how the products are suited to their own specific clientele—to the customers they serve.

All these opportunities for gleaning information, of course, are not only of service to the groups that visit the fair; they are of equal importance to the exhibitor. Both parties share in equal measure in the give-and-take. Visitors from the wholesale and retail trade adjust their stocks on the strength of what they observe at the fair; they bolster up their inventory, supplement or expand it, and above all bring it up to date so that they can remain competitive.

Visitors from industry attune themselves to what their suppliers, or their competitors, have to offer. They check the reception given at the fair to their goods—and particularly to new items—by talking with suppliers and buyers and swapping "shop talk" and experiences. Representatives from the trade are of special importance to industrial exhibitors because they stand one or two steps closer to the consumer and may have information that exhibitors will gladly apply to their products, production, and sales efforts.

It does not necessarily follow, of course, that the greater the number of buyers and sellers that get together, the better will be one's picture of the market and the greater one's business opportunities. The organizers must ensure that it is those elements that are sure to fulfill these market functions which are represented. This includes a majority of the suppliers who are most influential in the market. Nowadays this requirement is generally only fulfilled if foreign producers, influential in international trade, are represented.

Departmentalized Fairs

The result has been, and still is, a continual increase in the number of suppliers —and thus in the number of exhibitors— represented at the big international fairs, which have become larger and more complex. This has led to more specialized fairs and to an ongoing process of development. Specialized, or rather "departmentalized," fairs make possible a more comprehensive representation on an international basis of goods available (one of the prerequisites for the correct fulfillment of the functions of a fair), without making it too difficult for visitors to look around. In what respects should such a fair be "departmentalized"? Today this generally means that by grouping together the goods of one or several specific branches of a trade, greater effect is achieved. Just as these groupings have no fixed size, but vary from one country to another and from one year to another, none of today's "departmentalized" international fairs is established for all time.

Continuous observation of market developments and timely adjustment to the needs that arise from them are just as important to the organizers of fairs and exhibitions as they are to any other modern enterprise. Naturally this applies not only to consumer goods but to capital goods. For example, consider the Hanover Fair, where various groups of suppliers (such as woodworking, combustion engine, vending machine, welding, and forging companies) exhibit only once every two years, or the triennial ACHEMA exhibitions in Frankfurt am Main, devoted to chemical equipment and processing, where exhibitions and scientific discussions are combined.

Changing Concepts

There is no patented formula for organizing an international fair, except to sound out carefully the requirements of each group and to devise a tailor-made form of organization according to its needs. Certain basic principles, however, can apply generally. For instance, there should be relatively complete representation of the goods available, so that there may also be "complete" demand. The same applies to internationality. Exclusively "export" fairs, i.e., fairs consisting of domestic exhibitors aiming to attract foreign interests, are hard to imagine today. Only if the goods offered are international in character will they be attractive to an international audience—a situation parallel to the international exchange of goods, which has no "one-way streets." A good example is the Interstoff Fair in Frankfurt am Main, where

More than a half-million visitors inspected automotive and nautical exhibits at this year's 41st International Motor Show in Geneva, Switzerland (above), *a "departmentalized" fair. Madrid's biennial Feria Internacionale del Campo (International Country Fair), with exhibits relating to every phase of farming and country living, drew some 3,500,000 people in 1970 (bottom).*

At Paris's Salon International de la Navigation de Plaisance (centre), *pleasure boats of all kinds are displayed. The 1971 fair had 650 exhibitors and 310,000 visitors, including 12,000 from outside France.*

internationality has developed at almost the same pace on the demand side as on the supply side. Over two-thirds of the exhibitors and over half the buyers are from countries other than Germany.

International fairs of this kind can indeed act as "market guides" on a worldwide scale for the trades concerned, while still leaving room for related shows of more regional significance. Much depends on conditions in the branch or branches of industry concerned. If, from an international standpoint, a branch is considered relatively small, a selective international tour of several locations can in some circumstances be worthwhile. However, this will apply only in exceptional cases where distance, traveling time, and travel costs are no problem to either exhibitor or visitor. New forms of organization are being considered on the basis of the "Trade Marts" that have developed in the United States, and the general conception we have of fairs may change for functional reasons. Even today, at one extreme, there are fairs with completely enclosed stands, (e.g., Interstoff, and some sections of the Hanover Fair) and, at the other extreme, fairs with completely open stands where one cannot even see where the gangway ends and the stand begins.

European—and particularly German—fairs are backed by centuries of tradition. But this is not the main reason for their good reputation and leading role; it is rather their continual and practical capacity to adjust to the needs of the market. For German fairs, tradition means primarily to carry to perfection in modern times what our predecessors have begun. This will also be our task in the future.

An Altogether Superb Means

Growth in the international exchange of goods will be a decisive factor for generations to come. The needs of mankind will certainly continue to grow and these needs can only be satisfied if leading people in business and government of all countries are prepared to align their ways of thinking and their actions to broader geographical perspectives and, step by step, do away with all barriers that stand in the way of free, speedy, and smooth commerce among the nations. Many gains have already been made toward freedom of traffic in international trade but in the future many more must be achieved. Any and all steps in this direction will mean greater freedom, greater progress, more intensified co-operation, and better understanding of one another among all men.

But this future development we may expect in world trade will involve certain consequences for the businessman so far as his practical, everyday work is concerned. For him and for the management of any individual business, it will get more and more difficult to acquire the over all picture so necessary to make plans. Longer distances will become involved. More and more firms and their products will grow in importance within one's own marketing area. An ever-increasing number of items will be traded. Moreover, a constantly growing number of older lines of goods will be replaced by new products. One thing is certain: better means of conveying information and an ever more compact network of faster transportation facilities will have to play their part in minimizing difficulties in communication.

For this very purpose, international trade fairs are at present, and will remain, an altogether superb means of acquiring this over all picture the businessman needs to have. In the final analysis, fairs have proved to be of vital importance in every stage of trade development over the past 20 years, and it is clear that, with their many and varied functions, they are still of inestimable value to the economy. In view of the course this development of international marketing will take, fairs will most assuredly gain even more in importance in the future.

Carl Theodor Steidle is director of the Messe- und Ausstellungs-Gesellschaft, Frankfurt am Main, Germany, and vice-president of the Union des Foires Internationales (UFI). He recently concluded a series of lectures in the United States, giving his views on the present and future roles of international trade fairs.

PICTURE CREDITS

Page 24: Stadtarchiv, Frankfurt am Main
Page 25: (1) Messe-und Ausstellungs-GmbH, Frankfurt am Main; (2), (5), Rapho, Paris; (3) Publifoto, Milan; (4) Euroflora 71; (6) Brussels Fair Organization Committee
Page 27: *(Above)*: François Martin, Geneva; *(Centre)*: Neptune Magazine; *(Below)*: Foto Lorenz; Author's photograph: Sepp Jäger

Confidence About The Future

Selections from the Chairman's Address to Shareholders

by HENRY S. WINGATE

Facing the press before the Annual Meeting in Toronto on April 21: Mr. Wingate is flanked by (left) *President A. P. Gagnebin,* (right) *Senior Executive Vice President J. C. Parlee, and Executive Vice President L. E. Grubb.*

We are moving ahead. All of our production expansion efforts—the Canadian program and the projects overseas—are founded on your company's confidence in the long-term growth of the nickel market. We believe that the current softness of demand represents one of the lulls that will occur periodically in the upward growth trend of the nickel market. We estimate that primary nickel consumption will increase at an average rate of about seven per cent a year during the next 10 years.

The very nature of nickel—the superior engineering qualities it imparts to alloys—and our intensified product research and market development efforts, in tandem with the growth and needs of the world economy, will keep nickel demand heading up. The company's market research indicates that there will be a moderate surplus nickel capacity this year and next. And that for the balance of the decade the expected demand and the industry's capacity to meet it will remain in very close balance. Last year, estimated nickel consumption was a little under one billion pounds. We expect that by 1980 annual consumption will be about double that figure.

The increase in consumption of nickel by product category is particularly significant in the assessment of the future demand. Stainless steel production is a prime example. It accounts for the biggest share of all primary nickel consumed. In 1970, it doubled its 1960 take to over 400 million pounds. By 1980, consumption of nickel for stainless is expected to double again.

High-nickel alloys, the second largest consumer of nickel, also used almost twice as much nickel in 1970 as in 1960. These alloys are vital to all types of gas turbine engines and to many other high-temperature applications. As the decade of the eighties begins, we can expect the use of nickel in these alloys to reach some 200 million pounds a year. Incidentally, the company's rolling mills produce approximately one-half of the entire free world output of these high-nickel alloys.

We see ahead many growing applications for nickel-containing products. The huge requirements for energy, transportation and water are three examples where changes in technology are creating, or sharply increasing, market opportunities for nickel.

The demand for electrical energy in the free world is expected to double by 1980. It will be generated by burning

Photographs by Dennis Rider, Feature Four Ltd., Toronto

Messrs. Parlee and Grubb chat with Louis Renzoni, Vice-President – Special Technical Projects.

fossil fuels (coal, gas and oil), including the increased use of gas turbines, by hydroelectric installations, and by nuclear power plants. By 1980, some 20 to 25 per cent of electricity is expected to be generated by nuclear power. Since nuclear power plants place more severe demand on materials for resistance to corrosion and high temperature than do conventional fossil fuel plants, the high-nickel alloys will have a proportionately much wider position in the electrical power market than in the past. Altogether, the market for nickel in the construction of all generating facilities is predicted to rise from the present 40 million-pounds-a-year level to 100 million in the 1980s.

The twin demands for more energy and for environmental protection will also lead to the greater utilization of natural gas as a fuel for domestic and industrial heating and for electrical generation. A major new technology is developing to deliver natural gas from the remote areas where it occurs to the centres of population where it is needed. Economical methods utilizing cryogenic – extremely low-temperature – processes for transporting and storing natural gas in liquefied form have been developed. Currently, land and ocean transport systems for liquid natural gas are being constructed or planned in North America and Japan, as well as in Continental Europe and the United Kingdom. Stainless steels with 10 per cent nickel and INVAR* with 36 per cent nickel, as well as 9 per cent nickel steel developed by International Nickel specifically for cryogenic equipment, are prominent among the competing leading materials of construction in all of these systems.

The gas turbine, as a result of its success in aircraft propulsion, is rapidly becoming another significant means both for the generation of electrical power and for vehicular propulsion. The gas turbine offers a rapid solution to acute power shortages since it can be built and installed more quickly than conventional or nuclear generating equipment. At the same time, it has a lower potential for pollution than conventional plants fired by coal or oil. The next two or three years will also see the beginning of gas turbine-powered trucks and buses on the road, and these, along with turbines for other non-aircraft applications, will become major new consumers of nickel.

The magnitude of the planned control of pollutants requires the development of highly engineered systems that offer excellent market opportunities for nickel-containing alloys. In its broadest sense, environmental control includes the control of sewage and liquid effluents discharged into oceans, lakes and streams; the reclamation of water through treatment methods; and the reduction of harmful discharges from automobile exhausts and in industrial fumes. The control of pollution from automobile exhausts is illustrative of the importance of nickel to the new technologies. The systems currently being evaluated by the motor industry rely to a greater or lesser extent upon nickel-containing materials to provide durability and avoid impracticable replacement problems. Adoption of any one of the several systems could create new markets for many millions of pounds of nickel a year after the mid-1970s.

I have been focusing only on the comparatively new growing markets related to the field of energy. But we should remember that the markets for nickel-containing materials in long-established fields, such as consumer products, the plating and construction industries, electronics, and the chemical, petroleum and marine industries, will likewise move ahead significantly.

*Trademark IMPHY

After the meeting, officers and shareholders view a special exhibition on the people of Inco – in mining, processing, research, market development, sales, and many other activities.

WESTERN AUSTRALIA- THE GROWTH STATE

by DR. ALEX KERR

Since 1960 the economy of Western Australia has changed dramatically. Formerly underdeveloped areas are now yielding vast mineral riches, from bauxite and other minerals in the north, to iron ore, manganese, oil, and gas in the central latitudes, to bauxite, gold, nickel, and mineral sands in the south. The discovery and vigorous exploitation of these major deposits has spawned many mineral exploration companies, and the vast, hitherto mostly unknown land is being probed and picked over as never before. Where previously the individual prospector fossicked his way across the land, now bulldozers and mechanical shovels are biting into it as large exploration companies prove their reserves and look for more.

Until recent times the economy was predominantly rural in character. Extensive wheat farming and pastoral activities such as sheep and cattle grazing provided the main source of income. The economy had a substantial export surplus to overseas countries and a substantial import surplus from the other Australian states. Semi-arid conditions over much of the inland territory, a dearth of natural fuel, limited exploita-

Western Australia is a vast state. Yet its one million square miles (one-third of the Australian continent), bounded on three sides by large ocean masses and on the fourth by a formidable desert, harbors a mere million people. Since three-quarters of these are concentrated in the southwest corner, the population density in the remainder of the state is very low. This basic economic fact has given rise in the past to relatively high overall costs of transport, communications, and government and commercial services, and thus relatively high living costs. However, while the vastness of the land creates some economic problems, it virtually guarantees a wide range of soils, climate, mineral and other natural resources, and thus economic activities, all of which suggests a good development potential.

tion of local raw materials, a small domestic market, and a meagre supply of local investment funds—together these factors inhibited industrial development on any scale.

Mineral Finds And Development

The most spectacular of the mineral discoveries was the uncovering of vast resources of iron ore in the Pilbara area in the early 1960s. Its proven reserves of high-grade ore are estimated conservatively at 20,000 million tons. In addition, unmeasured reserves of potentially beneficiable lower-grade ores, containing between 20 per cent and 45 per cent iron, are estimated at 100,000 million tons.

With vigorous expansion already taking place, and an air of optimism pervading the state because of the iron ore, oil and gas, and other mineral discoveries which had attracted international attention a few years earlier, public interest at home and abroad was fired by the discovery of extensive high-grade nickel deposits in the southern part of the state, near Kalgoorlie. These were followed by further discoveries in other adjacent areas which had yielded vast

(Left) *In a semi-arid country, irrigation is as vital to the economy as to human life. A major project is the damming of the Ord River to irrigate the rich river plains for cotton and sorghum growing and to aid the beef cattle industry.*

(Right) *South of Perth is the Kwinana industrial complex, whose enterprises already include nickel and oil refineries, aluminum and fertilizer plants, and a blast furnace.*

quantities of gold at the turn of the century. Interest in these areas has not flagged, as more and more exploration companies are investigating them.

Eight companies have so far entered into agreements with the state government to develop these deposits. Capital expenditure on the projects already exceeds $600 million, and contracts for export and domestic sales now exceed $4,000 million for ore and pellets. New towns and ports have appeared where, previously, scattered sheep grazing was the only activity.

A Fruitful Partnership

One of the features of this development has been the manner in which the government, incapable of marshalling capital and expertise on the grand scale needed for exploitation of these resources, has concluded agreements with the private companies making them responsible for the provision of the necessary economic and social infrastructure. Each company is required to lay out and develop complete townsites at the mines and ports. They must also provide adequate and suitable housing, recreational and other facilities and services, roads, schools, water and power supplies, air strips, police stations, quarters, and hospitals. The companies may levy charges, where reasonable, on the use of facilities such as water, power, and housing, and they are not responsible for meeting the operating expenses in respect of education, hospitals, and police. By these means Western Australia's State Government has been able to achieve a rate of natural resource development much greater than that which would have been possible if it had been forced to rely upon its own resources of money and men.

Other natural resources began to be developed rapidly—beef lands, agricultural areas, and fisheries in the north; prawning, lobster fishing, and potash and salt production in the central coastal areas; and timber and salt production in the south. For example, in the Kimberley region an American group is investing about $18 million in seven cattle stations covering over four million acres. This irrigation farming and beef-raising project has marketing ties with the large Japanese trading house, C. Itoh and Company. In addition, the state's established agricultural and pastoral industries more than doubled in the sixties.

Though some of the capital expenditure for development has filtered out to other states and to overseas in the form of orders for equipment and payment of foreign experts, a great deal has rubbed off internally, and economic activity has increased strikingly. During this 10-year period, value of primary production increased by 98 per cent, value of manufacturing production by 170 per cent, and value of mineral production by 450 per cent. Value of retail sales rose by 106 per cent and value of overseas exports by 156 per cent. With growth occurring at such a rate, opportunities for absentee investment or for on-the-spot participation have been numerous, as many workers and entrepreneurs have discovered to their profit.

The Changing Face Of Perth

Increasing urbanization accompanied the quickening pace of development in the state. In the decade of the sixties, state population increased by 32 per cent and the Perth Metropolitan Region population by 39 per cent. One-half of this increase came from migration.

Manufacturing and commercial activity in Perth mushroomed to keep pace with the demands of urban growth, of the more distant mineral developments, and of the nearby burgeoning Kwinana industrial complex (a $100-million oil refinery, a $60-million blast furnace, a

Discovery of vast iron-ore deposits has transformed the face of Western Australia's remote Pilbara region.

(Left) *Drilling operations at Mount Tom Price.*

(Right) *Nearby is a modern town of the same name, one of several established in the region by major mining companies.*

Stockpiling solar salt at Port Hedland. Today Australia's biggest export port, only five years ago it was restricted to vessels of 5,000 tons.

The Mount Newman ore pier at Port Hedland, the only one in Australia that can accommodate a 150,000-ton and a 100,000-ton super ore carrier.

Production capacity at Mount Newman is expected to reach 25,000,000 tons of iron ore by April 1972.

$60-million aluminum refinery, a $35-million fertilizer and chemical plant, a $50-million nickel refinery, and other manufacturing enterprises). Perth's face changed almost daily as older buildings were torn down to make way for multi-storey office blocks to accommodate the varied enterprises flooding into the city. Accommodations and services were strained as the population grew rapidly.

In 1968 and 1969 the metropolitan population increased by 4.6 per cent and 4.9 per cent, respectively, and this stimulated the building and construction industry, which expanded its operations. Inevitably speculators moved in and land values in the Perth area rocketed upward from the mid-sixties onward. In the last year, however, government legislation and regulatory action have been successful in damping down the metropolitan land boom.

Activity on the Perth Exchange reflects the domestic and international interest in recent Western Australian development, particularly in the mineral field. Several investment advisory companies and portfolio management firms have been established in the last two or three years in all Australian capitals and several daily and weekly newspapers specializing in mining intelligence have appeared. Merchant banking houses and other specialized financial institutions have entered the money market and are operating in a big way by local standards. Fluctuations—sometimes dramatic—in the prices of mining shares, and the publicity they have received in international investment circles, have probably done more to direct overseas attention to developments in Western Australia than anything else.

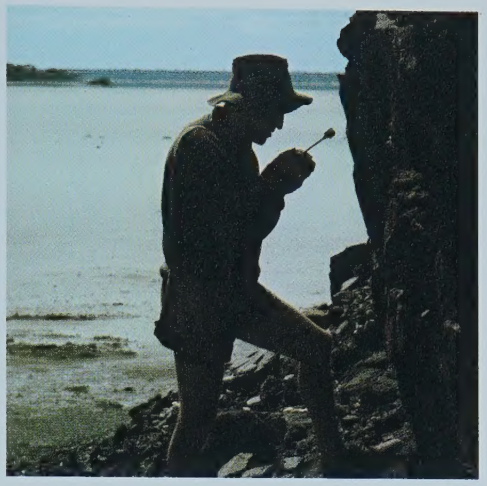
Growing Pains

Growth at such a rate could not, of course, proceed without headaches and heartaches. Inflation has been well contained, considering the extremely tight labor situation that developed, particularly toward the end of the decade. With 1966-67 as base 100, the Perth Consumer Price Index for 1969-70 was 109.4, reflecting an annual increase of about three per cent.

The extremely high rate of population growth threw a heavy strain on the building industry. Rapid expansion helped remove the excess demand for high- and medium-priced housing, but the industry lagged somewhat on the production of low-cost housing. Population inflow has eased off considerably in the current year and adjustment problems in this respect in the immediate future should not therefore create so much pressure in all directions as previously. This easing is probably only temporary, however.

Government resources were strained to the utmost to keep pace with rapid urban growth, particularly in the provision of public services and amenities. Industrial unrest emerged at various points and numerous strikes eventuated, although most were settled fairly quickly. As with the mining ventures, the government has required the private sector to provide funds for works that would normally be regarded as the responsibility of government. Housing project builders and land subdividers, operating as large-scale developers, have had to make contributions to the cost of bringing water and sewers to their boundaries, in addition to the normal requirement of providing full reticula-

An exploration shaft headframe marks the site of International Nickel's search for nickel at Widgiemooltha.



An Inco geologist working at Lake Lefroy.

Downtown Perth has been growing by leaps and bounds. Construction of tall office buildings has helped transform the face of the city.

tion of water and sewerage within their subdivisions. In this way some large tracts of land in the metropolitan region have been opened up.

Challenge Of The 1970s

The decade of the seventies presents a challenge to Western Australians and the government that represents them. The challenge is to achieve socially acceptable growth, not just growth for growth's sake.

On fairly conservative estimates, the state's population will increase by about 40 per cent between 1970 and 1980; more optimistic estimates would claim a 50 per cent increase or greater. Yearly iron export earnings will increase from $270 million in 1970 to $800 million in 1980. Further investment in iron ore mining and partial processing of ore to more sophisticated forms of blast furnace feed will take place. The year 1980 could well see nickel mines in operation, with reserves ranging from half a million tons or less to huge ore bodies of 30 million tons or more. Good prospects exist for the exploitation of payable finds of other base metals and more exotic minerals, and many experienced prospectors believe that the vast inland area of the state has still to yield significant deposits of a wide range of minerals.

Manufacturing production, which at the beginning of the sixties took second place to primary production in value terms but soon bridged the gap, is advancing strongly and can be expected to expand rapidly in the seventies. In this regard, domestic market size limitations may still impose some restrictions on the possibilities of gaining important economies of scale in some directions. Counterbalancing this factor, however, is the close proximity of Western Australia to growing markets in Southeast Asia. Trade with these countries will undoubtedly increase.

Mining royalties have already expanded to a point where they are making a welcome contribution to state finances and they will grow even further —to about $25 million a year. This income, and much more besides, will be eaten up as the government experiences unabated pressure to provide a wider and deeper social infrastructure for all-round development.

All in all, the Western Australian economy has so far adjusted well to a situation of almost feverish development activity. The atmosphere in the capital city, as in the mining areas, has changed noticeably. Relative calm has become bustle and anticipation. There are those who regret this. Others see the changes as the inevitable concomitant of rapid growth. The important task is to ensure that the economic growth that is yet to come (and few would doubt the still enormous potential of this vast state) proceeds in as orderly a fashion as possible and has due regard for the preservation of human dignity and social values.

Reader in Economics at The University of Western Australia, Dr. Alex Kerr's major interests are in the fields of Economic Development and Regional Development and Planning. He has worked in Thailand (with ECAFE 1963 and 1964 and as Visiting Leverhulme Fellow at Thammasat University in 1969), Indonesia (under the Colombo Plan), New Guinea (on Regional Development), and the United States (as a Visiting Professor at various universities). He has published five books and contributed numerous articles to journals and conferences.

PICTURE CREDITS

Pages 30, 31, 32, 33, 34, 35 *(right):* Department of Industrial Development, Western Australia
Page 31 *(map):* Bernard Gervey
Page 35 *(left and centre):* Lance Nelson

BADLANDS INTO FARMLANDS

Canadian bluegrass, with rye as a companion crop, took hold on a plot of barren mine tailings—and grew. To Clare Young, this was one of his career's most successful moments.

At a ceremony in Washington, D.C., this June, Mr. Young had another proud moment, as he stepped forward to receive the first Environmental Conservation Distinguished Service Award of the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME). From the time in 1957 that he was named head of Inco's Agricultural Department at Copper Cliff, Ontario—in fact, since he joined the department 20 years earlier—Mr. Young has been recognized as an innovator and leader in his field. A citation prepared in his honor called attention to this record:

In appreciation of a lifetime of steadfast dedication to environmental conservation and in recognition of the successful transformation of mining badlands into fertile farmlands.

Extensive tree planting, improvement of grain and potato plots, studies of the effects of sulphur dioxide on forest species—Mr. Young has contributed much. But "rye on the rocks"—700 acres of grass and trees where desolation once reigned supreme—is undoubtedly one of his proudest achievements.

John S. Bell, of Humble Oil & Refining Company, 1971 AIME President, makes the presentation to Clare Young.

PICTURE CREDITS

(Above) Derek Wing, Inco Canada
(Below) Courtesy of AIME

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